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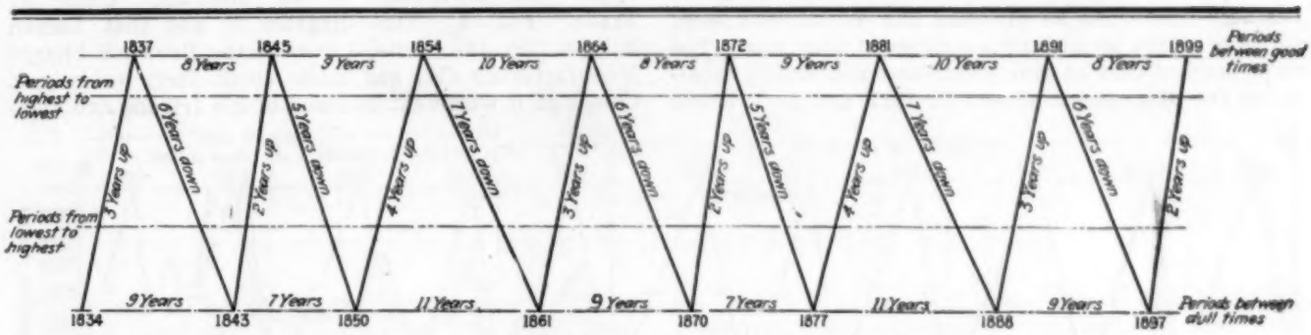


Fig. 1—A pig-iron price chart from the "American Machinist" of 28 years ago

The Business Cycle

By Luther D. Burlingame

Industrial Superintendent
Brown & Sharpe Manufacturing Co.

The strange sequence that seems to affect the years of prosperity and depression—An old *American Machinist* chart brought up to date—Sharpe's circle of trade

THE title of this article, "The Business Cycle," is an expression that has come into common use as standing for a recognized phenomenon of trade conditions. Now at the beginning of another year much space is being given in the public press, and in trade journals, to statistics dealing with this subject; the present condition of business, its past fluctuations, and prophecies for its future. Prominent among the products listed in the reports as indicating these fluctuations is pig iron, the price of which has been considered by some as one of the best barometers we have to show by the rise and fall of the price per ton the rise and fall of business prosperity.

The prominence given to the study and analysis of business conditions at the beginning of the new year, following the constructive and important steps taken through Secretary Hoover and the Department of Commerce, in investigating and determining the underlying causes of undue fluctuation including the problem of unemployment, and making suggestions for improving these conditions, shows the importance that is now being placed on the efforts to stabilize business, and the feeling that this is a subject which can be taken from the realm of chance and treated as a problem capable of solution.

This whole discussion brings to mind a chart, which was published in the *American Machinist* of Dec. 16, 1897, Fig. 1, showing the fluctuations in the price of pig iron during the preceding period of more than half a century, dating from the year 1834, and in the accompanying description pointing out that these fluctuations coincide with prosperous and dull times in the country. These fluctuations in the price of pig iron and the corresponding ups and downs in business divide into cycles of 27 years, each of these cycles having three irregular waves of good and bad times which repeat in the same order in each cycle.

This chart aroused considerable interest at the time, and raised the question as to whether there was any law governing such fluctuations, and whether it could be expected that these same waves and cycles would be repeated in the future.

To investigate the check-up on this, a copy of the chart was made with the same wave periods projected into the future as a prophecy of what might be expected. From year to year since that time as the prices of pig iron have been reported, a record has been entered on the chart, Fig. 2. This shows not only that the price of pig iron, but also general business conditions, have followed closely the predicted conditions indicated by the chart during the succeeding years.

The chart shown in Fig. 2 does not take into account the decreased value of the dollar accompanying the disturbances caused by the World War. When this is allowed for on the basis of the dollar value as reported by the National Industrial Conference Board, the coincidence between the hypothetical wave lengths and the actual conditions is even more pronounced, as shown in Fig. 3. These charts give the extreme fluctuations in the price of pig iron.

Another coincidence is that the Civil War in this country occurred at the same corresponding period in the cycle as did the World War, *i.e.*, near the end of the long drop of seven years from the preceding peak.

If the point is raised that a world cataclysm like the Great War coming unexpectedly as it did would produce

fluctuations upsetting any predicted business cycle it can be pointed out that in the minds of many economists war is considered to be the result of economic conditions rather than their cause, and that such disturbed business conditions as preceded the World War were in their minds an underlying cause of that war. The most marked case of war conditions abnormally modifying the diagrams is shown in 1917 and 1918 where

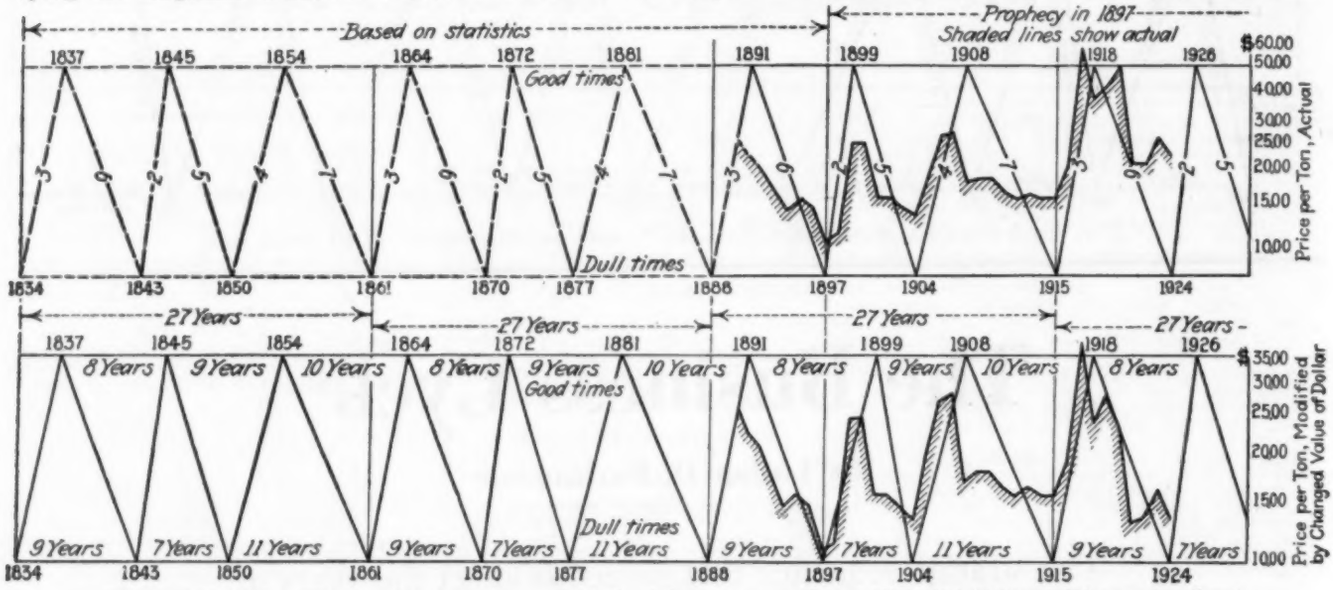


Fig. 2 (Above)—The pig-iron chart projected without correction. Fig. (3) Below—The same chart corrected for fluctuation of the dollar

arbitrary Government control of pig iron prices brought them down materially from the peak of early 1917.

If any dependence can be placed upon the ups and downs of business as indicated by the varying prices of pig iron in these charts, not only should prices now continue to rise, reaching a high peak in the year 1926, but a corresponding period of prosperity can be expected throughout the country.

In a series of articles in *Management and Administration* by Joseph H. Barber, entitled "Forecasting Your Industry's Cycle," the author takes it for granted that there will continue to be cycles varying for different lines of industry, and that a record and study of these can, by proper analysis, become the basis of predictions for the future that are much more than mere guesses. Emphasis is placed on the need of studying the different cycle for each industry, and learning how each particular line of business is affected by the cycle curves of other industries.

On the other hand, *Industrial Management* for January, 1925, contains a report of an address by Professor Irving Fisher at a meeting of the American Statistical Association in which he told his audience that the so-called "business cycle" is a myth, his meaning apparently being that the necessity for it is a myth, as he follows by saying that its unnecessary recurrence is a great economic waste, thus admitting its existence. His plan for avoiding these cycles is to stabilize the dollar by having the Government supply or withdraw money as the price fluctuations develop. The editor remarks that there is a prospect that the proposed legislation will be the myth, and that cycles will continue as the reality. That the business cycle *should* be a myth, and that business should be conducted on a stable basis without the marked fluctuations which have been so destructive in the past, will not be denied. No way has yet been found, however, to bring about a stable condition. This may be because of the law of trade, well illustrated by the diagram, "Circle of Trade," Fig. 4. This diagram is one that Lucian Sharpe, then the business head of the Brown & Sharpe Manufacturing Co., had made about forty years ago. Copies of it were sent to many of his friends and business associates to illustrate the difficulty of stabilizing trade. The thought it conveys is no doubt one of the fundamental reasons for the fluctuations which the diagrams of pig iron prices show to have occurred in this country during the last ninety years.

At the time of the publication of the original chart in the *American Machinist* no satisfactory explanation was given for its variations and a study of conditions since that time has failed also to give any reason as to why

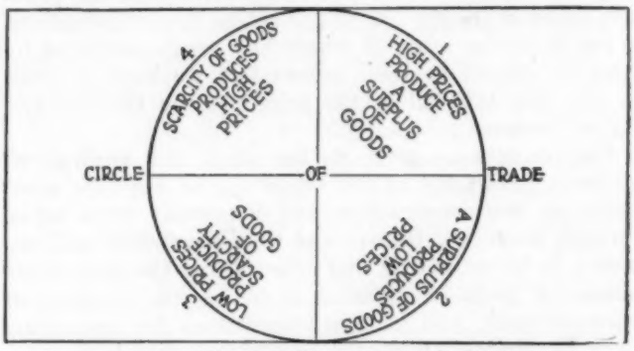

CIRCLE
OF
TRADE
1 HIGH PRICES PRODUCE A SURPLUS OF GOODS
2 SURPLUS OF GOODS PRODUCES LOW PRICES
3 LOW PRICES PRODUCE SCARCITY OF GOODS
4 SCARCITY OF GOODS PRODUCES HIGH PRICES

Fig. 4—Lucian Sharpe's trade circle

there should be a recurrence of the particular wave lengths shown. It may be but a singular coincidence. On the other hand there may be some explanation to this problem—a problem which is more elusive and yet the solution of which is much more worth while than that of the complex crossword puzzles of the day.

Whether or not there is any basis in economic law for this sequence of waves of prosperity, may we not, because of the fact that there has been such sequence in the past, look for "history to repeat itself" and expect in the next two years a rising tide of prosperity?

Typical Turret-Lathe Tooling

By Fred H. Colvin
Editor, *American Machinist*

A few examples of modern tooling methods in which standard tools are employed on a large variety of lathe work on Warner & Swasey machines

IT IS not so many years ago that we thought of turret lathes except in connection with fairly large quantities of work. The need for special tools in many instances and the time required for setting them up put turret lathes hopelessly out of the running for jobs where but a few pieces were needed.

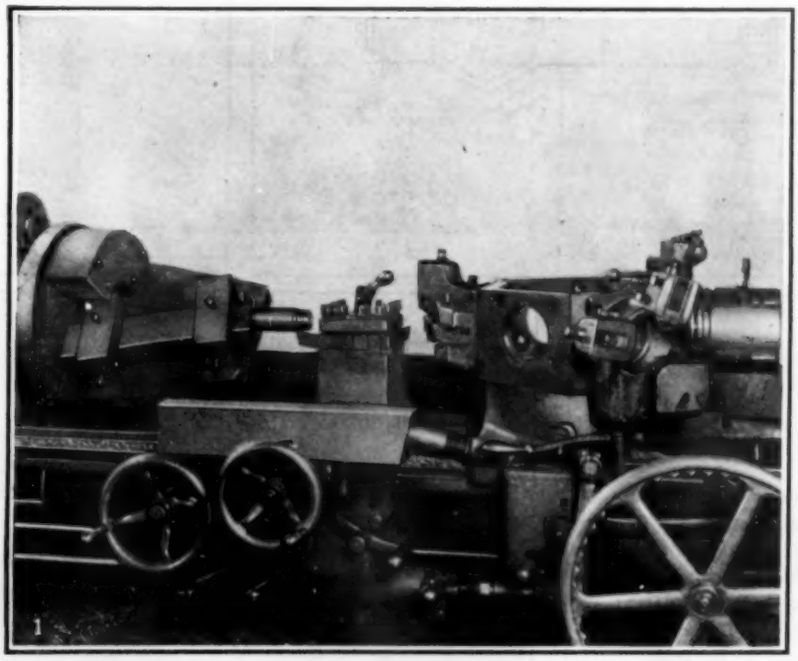
Several years ago, however, the need for simple, standard tools began to be studied and such progress has been made that we now find turret lathes in use where the size of the run is small and frequently in job and contract shops, as well as where machines or parts are manufactured. I have recently been in shops where the claim was made that in some cases, it paid to use a turret lathe with simple tools on a single piece. Where even half a dozen pieces were to be made the saving was said to be considerable.

At just what point in manufacture the use of turret lathes becomes economical, depends solely on the judgment and experience of the shop manager. Circumstances alter cases and there is no hard and fast rule that can be applied under all conditions.

The illustrations have been selected as typical of work successfully and economically done on turret lathes. In nearly all of the jobs referred to the setups are shown by halftones, while the details of the tooling are shown by line cuts placed under the halftones.

While the descriptions of the operations on each piece done by the tooling shown are concise, they will enable the reader to form a mental picture of the economy effected by tooling arranged by experts after careful analyses of the work.

This article is the first of a series illustrating the tooling of turret lathes and shows methods that have been successfully applied to Warner & Swasey machines.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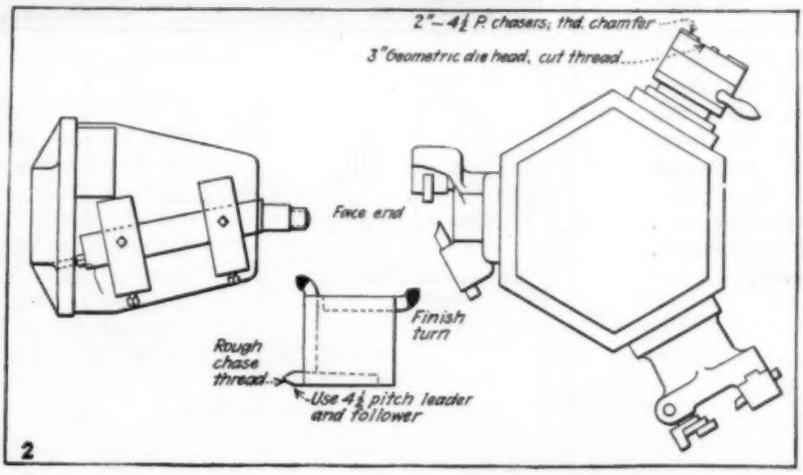
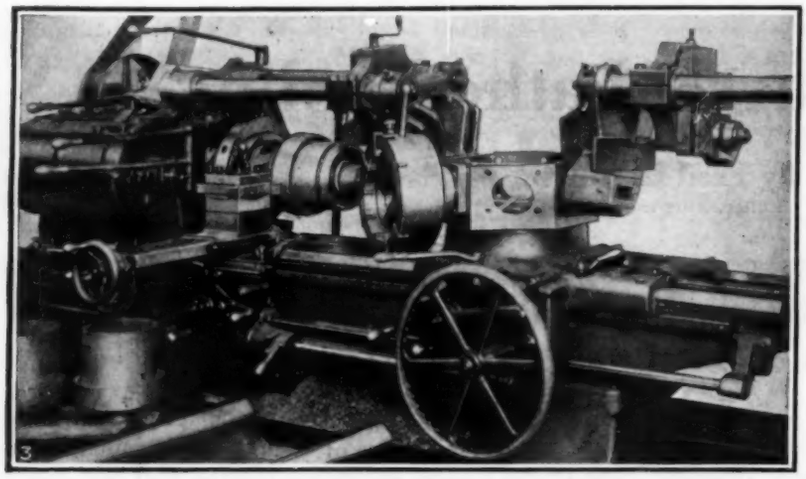

2"—4½ P. chasers; thd. chamfer
3" Geometric die head, cut thread
Face end
Finish turn
Rough chase thread
Use 4½ pitch leader and follower
2

The first example, Figs. 1 and 2, is the turning and threading of an angular end on a bar that goes on a crane. The threaded part is 2 in. in diameter, 4½ threads per in. The work is held on an angleplate. Tools and roller rests are easily adjusted. The layout is given in Fig. 2. The tool holders bolt directly to the face of the turret and avoid undue overhang. The cross-slide toolpost is substantial and carries 3 tools, the fourth place being left blank. The operations are: 1—Load. 2—Rough turn and face with square turret. 3—Finish turn. 4—Turn thread diameter. 5—Face end. 6—Rough chase the thread with square turret. 7—Finish thread with die head. 8—Remove. Time, 35 min. each; former time, 2¼ hr. each.

Further examples follow, showing a variety of work with the sequence of operations and the time required.



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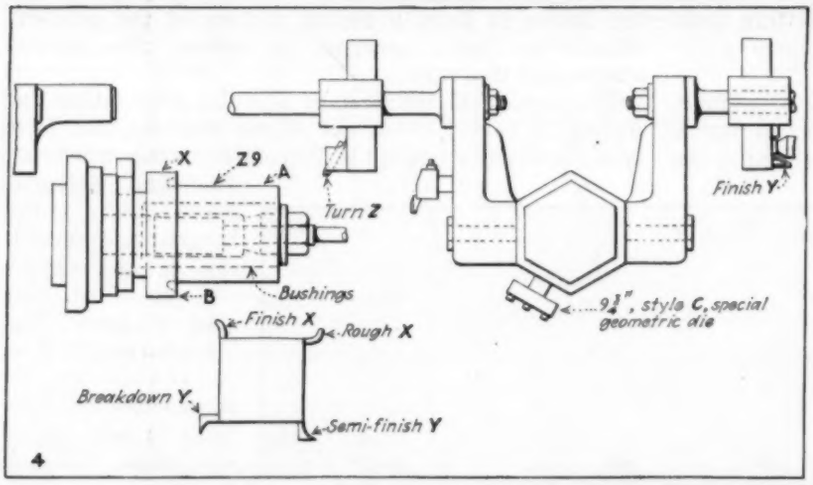
In Fig. 3 is shown the 3A hollow-hex turret lathe set up for a cast-iron commutator bushing and in Fig. 4 the tool layout. The operations are: 1—Load. 2—Rough turn *Z*; turn *A*; face. 3—Rough turn *X*. 4—Finish. 5—Rough *Y*. 6—Semi-finish *Y*. 7—Finish *Y* and form radius *B*. 8—Thread. 9—Unload. Time, small size—13 min. each; large size—15 min. each.



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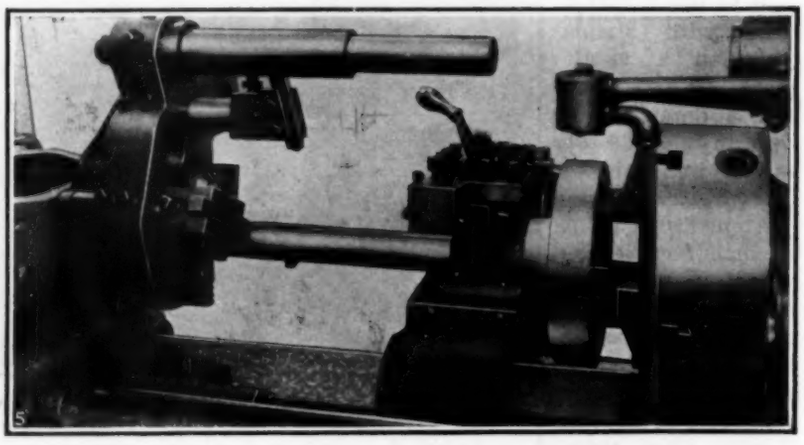
The job shown in Fig. 5 is a 12-in. cast-iron pulley with a 3-in. face and a hub 5 in. long. The machine is a No. 1 hollow-hex turret. The bore is 2½ in. The outside turning tool is of stellite on account of the high speed at the surface. The cross-slide tools are also of stellite and for the same reason. Fig. 6 shows the tool layout. The operations are: 1—Chuck. 2—Rough turn, bore and face. 3—Finish turn, bore and face. 4—Ream. 5—Remove. Time, 5 min. each.



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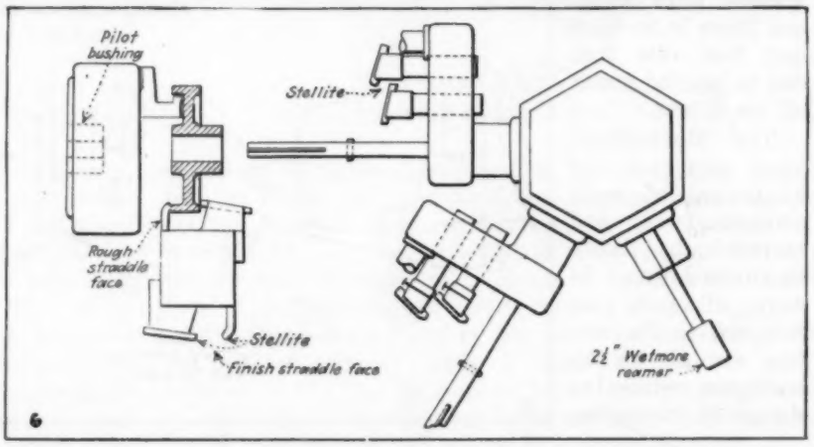

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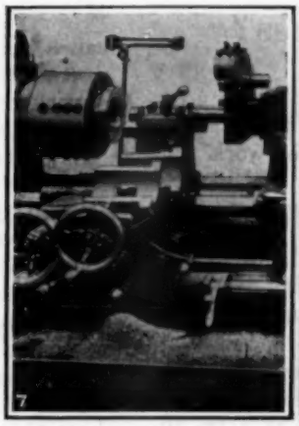
Two operations on a bearing liner are shown in Figs. 7 and 8. In the second operation, the liner is held in an air-operated ring fixture, the outer end being supported by a bell center. After the finish turning, a ring is lightly pressed over the outside and the bore finished. The accuracy is 0.001 in. plus or minus. The machine used is a No. 3 hollow hexagon.



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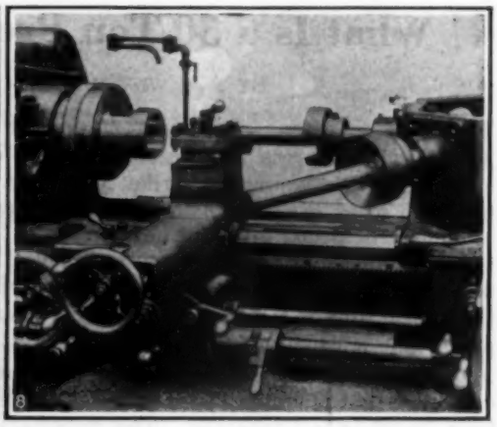

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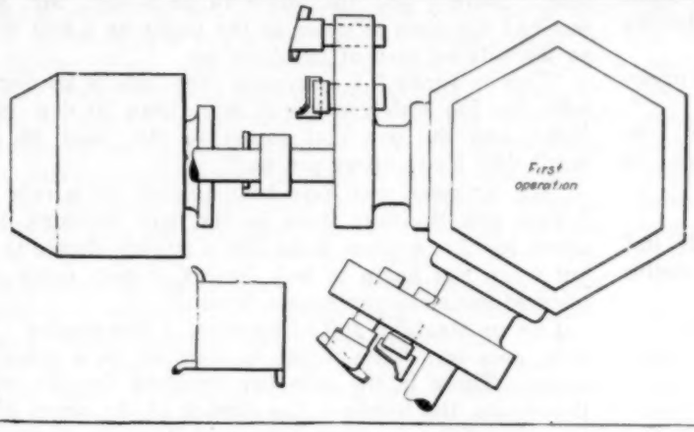

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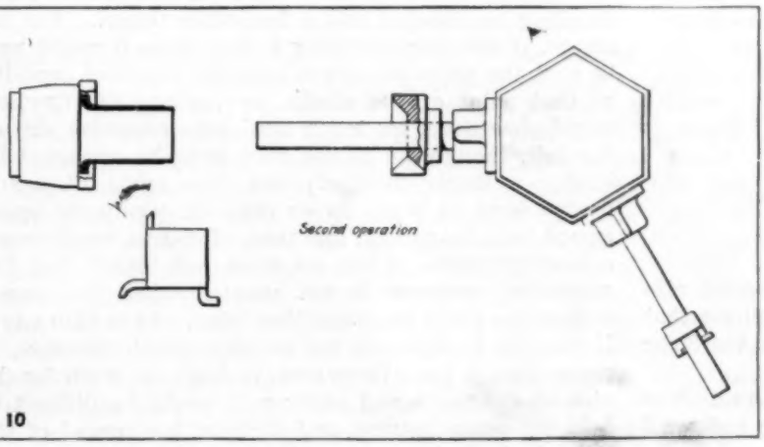

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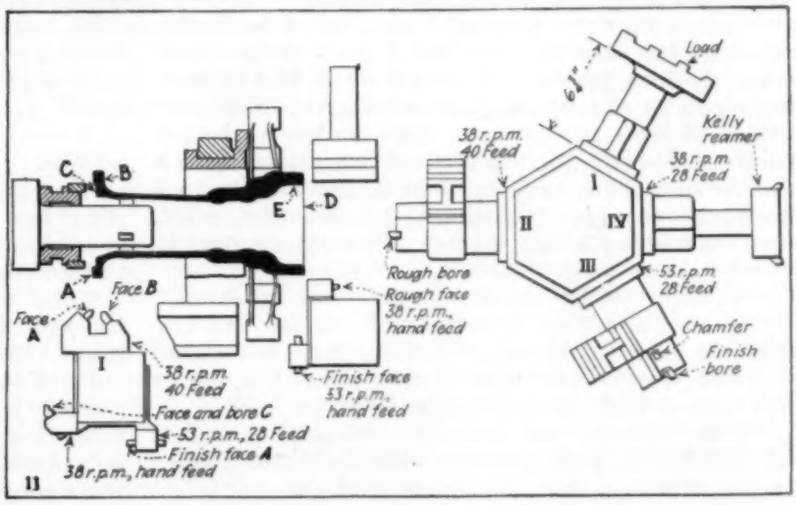
The tooling layouts are shown in Figs. 9 and 10. The operations are: First chucking; 1—Load-flange end forward. 2—Rough bore, turn, form with hex turret and rough-face flange with square turret. 3—Finish turn and finish-face flange. 4—Remove. Time, 12 min. each; total time 21 min. each.

The tool layout on a rear-axle housing for a truck is shown in Fig. 11. Two carriages operate simultaneously, one at each end of the work. The operations are: 1—Load. 2—Rough bore *E*, face *AB*, rough face *D*, face and bore *C*. 3—Finish bore *E*, finish face *D*, finish face *A*. 4—Ream *E*, back ream *C*. 5—Remove. Time 10½ min. each.



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What Is a 50-Ton Press?

By A. Kwizzer

EVERY so often I am confronted with the task of selecting a press to do a certain piece of work and every time this happens I strike two rocks. I'd like to navigate so as to avoid them but don't know how. Can somebody help me, and will he?

The simplest problem I meet is to select a press for blanking or piercing work. I figure twenty-five tons for every square inch. For instance when I have to punch out a square, 4 in. on a side, in ⅛-in. metal, I figure on a 50-ton press and, generally, allow something on top of that amount. There are four sides, each 4 in. long or 16 in. all together. The thickness is ⅛ in. so that the section to be punched is $16 \times \frac{1}{8} = 2$ sq.in. So far so good, but now comes the question of selecting the press.

I have a little conversation with my friend the press-maker and it runs something like this:

"Mr. P.M., I want a press to blank 4x4 in. in ⅛-in. steel stock and I figure that I need a 50-ton press. Is that right?"

"Yes, quite so. What stroke do you want?"

"Well, figuring on the stripper, let us say 2½ in." After which Mr. P.M. consults his catalog (and possibly his delivery sheet) and announces:

"Our XY-276 press is just the thing for you."

"Is that a 50-ton press?"

"Yes, sir."

"And does it have a 2½-in. stroke?"

"Yes, sir."

"It will punch out 2 sq.in. of steel?"

"Yes, sir."

"For instance 4x2 in. and ¼ in. thick?"

"M..... m... Yes."

"Or 1½x1½ in. by 0.888 in. thick?"

"No not that. That would be too thick."

"Well, how about 8x8 in., by ⅛ in. thick?"

"M... m... m... Yes."

"Or 16x16 in., by 0.008 inch?"

"No, that is too big."

"Too big? But it is only 2 sq.in. In fact every size I mentioned was only 2 sq.in. and yet you tell me that one is too thick and another one too thin, or too large in area, which is the same thing.

"Well, sir," says the P.M., "You leave this to us. You tell us exactly what your requirements are and we'll give you a press that fills the bill."

"That is very nice of you," I say, "and I feel really thankful for your kindness, but I don't always know what the next job is to be and I would like to have some rule by which I can judge whether I can do some other job with this press or not. Just now the job measures 4x4x⅛ in., but in a month or so I may have a thicker or a thinner one and I would not want to have to write you every time a new job presented itself. Can't you give me such a rule? Then I'll not have to bother you so much."

"No bother at all; we like to assist our customers."

"Ever so nice," say I, "but I'd like to have the rule just the same. You see an occasion may arise when I would have to buy a press from somebody who is not quite so kind and accommodating as you are."

"Well," says he, "our rule is that the press is capable of exerting the given pressure when the crank is at an angle of 20 deg. from the bottom of the stroke."

"Now you are talking. That is fine. That's what I call a simple rule. I must try this out."

I draw a little diagram, in which a circle represents the path of the crank. By the time this crank has come to within ⅛ in. of the bottom we have a triangle in which AO is 1⅛, and BO is 1⅛ in., so that $\cos AOB = 0.9$, and therefore the angle $AOB = 26$ deg. Meanwhile Mr. P.M. has patiently waited.

"Well, what did you find?" he asks.

"Mr. P.M., I am more puzzled than ever. I find the angle to be 26 deg., and so you must be mistaken when you say this press is right for the job."

Ensues a period when we put our heads together and go over every item. The result is 26 degrees.

"Well," I say, "before we discuss this I'd like to try out another combination," and I take the 16x16x0.008-in. size. There I find the angle to be 8 deg. Mr. P.M. has had his nose as close to the paper as I had mine, so there is no need of checking up.

"This is funny," I announce, "the rule is 20 deg. or less; the job which makes it more than 20 deg. is all right, and the one that comes to less than 20 deg. won't do. Now, where are we?"

"Mr. Kwizzer, you have been asking for a rule and I gave you the best there is, but you shouldn't have asked for it. A press looks like a mighty simple thing, but when you begin to look into it, it gets more complicated the more you reason it out."

I sit up straight, full of interest; I like puzzles. Mr. P.M. goes on: "The things to consider in a press are many. There is the pressure required for the work, the stroke, the flywheel, the stretch of the press itself, the size of the crank, the shear of the tools, if you are blanking or piercing and a few other things. For instance, if you were blanking a thick piece it might well be that the press would not have the required capacity at that point of the stroke, or perhaps the flywheel would slow down too much and cause excessive slip of the belt, though, of course, that could be corrected by having a larger flywheel; but then again, it would be too hard to start up or make it regain its speed except by a heavy belt, and that, of course, would mean a heavier press. Then we must not forget that the maximum pressure is not exerted when the punch strikes the work, but some time later. As to thin work, if the job is thin and yet requires much pressure, it means that it has a large area, perhaps too much for the size of the press and anyhow it would be difficult to hold the punch square, and further, the spread of the crankshaft would require it to be heavier and . . ."

He is still going when I wake up after a pleasant doze. I say:

"Now please tell me what is a 50-ton press and when is it?"

"I was telling you just now," with just the ghost of a smile.

"And then there is another question I want to ask you. Just how do I figure the required pressure for any job, say forming or embossing or deep drawing or anything at all?"

"I'll be glad to discuss this with you some other time, but now, I am sorry I'll have to hurry to make my train. Meanwhile if you will just sign here, for the order of the XY-276 . . ."

I do. He hands me a cigar and leaves. I had slept through a unique chance to learn what a 50-ton press is, and why, and, I would hate to ask P.M. again. So won't somebody please tell me?

Judging and Selecting Men

By William Davenport

Some simple rules that will help the foreman or superintendent in hiring men that will stay hired—A few of the things that should not be done

MILLET, the celebrated artist, once said, "The secret of art is choosing the right paint and putting it in the right place." Very simple and sufficient, if one only knows exactly how to do it.

And the underlying principle stated here, is as applicable in industry as anywhere else. At the very point where we secure the individual workers, carelessness, ignorance or indifference is fatal to the organization.

An Ohio manufacturer said to Joseph Hays, recently, "Just so long as you hire men the way you buy cast iron, just so long you will get cast-iron men, from the neck up as well as down." In proportion to the total number of industrial plants operating, the number having a well-organized employment department devoting its time to the scientific selection of men, is comparatively small. This means that as a rule, superintendents and foremen who are burdened with many other duties, must do the greater part of the selecting and hiring of workers; and that they must prepare themselves for this important task as fully as possible. While lack of time may prevent such an executive from exercising as much care as would be desirable, there is little excuse for such an incident as that related by Nathan W. Shefferman. He tells of a plant of some importance where a worker injured his arm. As he was under pay during the time of recovery, it was deemed advisable to find some work for him to do. He was therefore put in charge of employing new men. His own statement of his method is interesting. "If a man approached me and I liked his looks, or if he smiled, I would ask him where he had worked. If he spoke of some place I had heard of I gave him a job. If I did not like his appearance, if he did not appeal to me, I turned him down."

But there are not a few places today where little more care or good sense is used than in this glaring instance. And while it may not be possible for the average executive to go into elaborate details in interviewing prospective workers, there are some fundamental principles that can be employed and some every-day, common sense that can be used.

Value of First Impressions

Appearances are deceptive, but most men, by little and insignificant things, reveal character and abilities. And upon a man's first approach, we may learn to tell several things that will serve as a guide for future further examination. What is his apparent physical condition? Is he large or small? Does the skin show evidence of a good digestion, or the reverse? Does he seem restless and nervous, or calm and steady? Does he look you squarely in the eye while talking? Is his clothing neat and clean? Does he seem to warm up to you as you talk and show an interest in what you have to tell him about the plant? Is he talkative and does he show a tendency to boast about the jobs he has held? What about his position and carriage, both sitting and standing—does he stand and walk erect and straight, or does he slump down in the chair when sitting? Thus far it has not been necessary to ask a single question and yet the examiner, if he has trained his powers of observation, knows almost enough upon which to base a decision for many types of work.

The Kind of Record Needed

The executive should, however, endeavor to go much further than this. The man before him may make an efficient and loyal worker, he may be a careless man who will ruin hundreds of dollars worth of material or he may, in a moment of thoughtless operation, wreck a machine costing thousands of dollars. Cards for the purpose of keeping records of each man's qualifications may be prepared easily and are invaluable for future reference, as well as for immediate information. These need not be as elaborate as those sometimes used by an employment department, but they should include such essentials as will give the employer a good opportunity to form a fairly correct opinion of the man making application for work.

It should be noted that in the suggested blank illustrated, the information is really divided into six sections, viz., general, education, knowledge of work, home conditions, adaptability and ambition. A little careful thinking will show how each of the questions will help to determine the applicant's possible worth to the organization.

This record is general, however and should be supplemented by more detailed information, based upon the type of work to be done. For example, if the job is one where heavy laborers are needed, one must make note of strength, endurance and docility. If it requires light laborers, the question of endurance is still important, but special attention should be given to alertness and quickness. In selecting molders, obviously the qualities to be observed will be strength, endurance, experience, intelligence and education. Heavy machines to be operated will call for strength, experience, fair intelligence and some education, whereas light machine work will require alertness and deftness of hand, rather than strength. If we are seeking men for heavy assembling, we very naturally should look for endurance, strength, intelligence and knowledge of machinery, but for light assembling, training, experience, deftness of hand and patience must be taken into consideration.

Within the limits of this article, it will be impossible

to discuss the various tests used in some plants or to estimate their value; we are more concerned here with the importance of the personal element in interviewing applicants for jobs. And there is no department of industry where there is greater need for tact and skill than in this work. Every concern, like every individual, acquires a reputation and from the employment standpoint that reputation is determined largely by the way in which men are hired. Some plants are so favorably known that they have a considerable waiting list on hand all the time from which to select the best help obtainable.

APPLICANT'S RECORD

GENERAL

Name .....

Address ..... Phone Number .....

Age ..... Height ..... Weight .....

PHYSICAL	ENERGY
Sight	Fast .....
Hearing	Slow .....
Muscular	Constant .....
Feet	Spasmodic .....
Hernia	Easily Fatigued .....
Habits	Endurance .....
Recent Illness	
.....	

EDUCATION

Training		*Accuracy*
Primary	Blue Prints	Careful
High School	Slide Rule	Think Straight
College	Micrometer	Does he express himself clearly?
Technical	Memory	

ADAPTABILITY		AMBITION
Cheerful	Gloomy	Definite goal in view
Enthusiastic	Dull	.....
Hot Tempered	Patient	Hobbies
Suspicious	Confiding	.....
Open Minded	Prejudiced	Favorite Amusements
Conceited		.....

KNOWLEDGE OF WORK

Kind of work in last three jobs	How long?	Why leave?
.....		
.....		
.....		

Other experience

.....

HOME CONDITIONS

Married	No. rooms	No. working
House	Condition	Rent paid
Flat	No. in family	Distance from shop

A suggested form of employment record

While no hard and fast rules can be laid down, there are a few principles that are simply the dictates of common sense, since all the worker's future relations to the company may be decided by his first reception. In the first place, it is well to go on the assumption that every man is entitled to courteous treatment. Whether he receives it or not, will depend very much on the attitude of the examiner.

It should be remembered that the applicant has taken a long trip to reach the plant. This has cost him something out of meager savings and he may have had to wait for an hour to meet the executive. The latter is in the position of trying to buy the services of a good man in which work he can be materially aided by selling the man a good job. If at the outset he assumes a gruff, snarling manner he may not only do an injustice to a worthy applicant but he may work an injury to the company by losing the chance to secure a good man.

The interviewer should also be careful about "snap judgments." First impressions based upon general opinions, are likely to be erroneous. The caller is anxious to get a job, and this very anxiety may make him nervous and ill at ease. He is likely, under such circumstances, not to be normal and may, even for all his efforts to do otherwise, give a wrong impression. A few tactful words at the right place will do much to relieve this tension and place both men on a common footing. Nor should undue emphasis be given to single facts developed in the interview.

If the man has changed places often, there may be good reasons for it. If he appears deficient in some knowledge or experience, he may be unusually quick to learn. If he had trouble at his last place, it might possible be the fault of his foreman. The only fair and just way is to learn all the facts and then balance each one against all the others. This will give the executive the judgment upon which to decide fairly to all concerned.

Some interviewers question a man as though he were a criminal on trial, asking all manner of personal and confidential questions. This is not only unnecessary, but it gains nothing for the company and may make an enemy by creating a false idea of the plant. All such questioning should be done with judgment and have back of it a sound reason and a definite purpose.

How Employers' Associations View Apprenticeship Training

By Gerhardt F. Meyne

EMPLOYERS are endeavoring to solve the problem "How can vocations and educations be most practically combined?"

They have no particular regard for educational theories. In educational matters they believe creating and arousing a desire to learn to be the big thing, as the three R's of today, represent a whole lot more in study and education than formerly. They believe that, when the desire to know something has been created, many whose start has been humble, in their more mature years, can acquire and have acquired the love for the literary arts, the classics, and those other cultural attainments that go to make up the requisites of gentility.

There is practically no difference in instruction given those who are ambitious to become professional men, and the instruction given those who are neither leaning, inclined, nor ambitious toward the profession, who neither have the means, desire, ability nor endowment to enter the professions, but are content to earn an honorable living at a trade or vocation.

Less Preparation for the Professions

The employer protests against the prevailing system that provides that most of the education after the seventh grade is directed toward some one profession. Ninety-two per cent of our young never get to college. Approximately five per cent graduate. The employer is interested in what is being done for the youngster up to the age of sixteen, and how his lifetime is being utilized for the benefit of himself, the public and his future employer. It should not be necessary for the young man who desires to become an artisan to burden himself with many of the subjects now taught, and in which he has no interest whatsoever. He should not be required to study the same general subjects as the youth who has a leaning or an ambition for the professions. He should be taught the use of his hands, mind and body. The employer objects to the general tendency to encourage students to become members of professions where there is no decided leaning for them. Academicians, for some unaccountable reason, and the American parent, seem to think that the professional class and semi-professional class possess greater gentility and are something superior to the artisan. Could these people but see the numerous opportunities that are constantly presented to the vocationally trained man who knows his trade fundamentals, they would view him in greater appreciation. The vocationally trained man cannot only aspire to the heights in industry, but, what is more, if he applies his endowments, training and ability, he can actually arrive.

The reason the employer feels that the public schools should do a part of the training where it has to do with skilled artisans is because he is in competition for apprentices with other industries that do not require any period of learning, and where the apprentice can at once become a producer, and who are able to pay considerable more money in bidding for his services. The employer of skilled men is under considerable expense to train boys as it takes the time of his foreman and of the journeymen to say nothing of the loss in the spoiling of materials. He cannot offer the wage that the mass-producer offers. Yet he must have mechanics and it is up to him to do something about it. He is blamed for high costs and he is appealing to you.

The public schools today, aided by the machinery set up by the Federal Board of Vocational Education, the State Board of Education, and the local education boards, will have to be the vehicle to help to train skilled artisans. It is possible to teach the rudiments of most skilled trades in the public schools. It has been demonstrated possible in the so-called trade schools with the excellent results in numerous places, and it has been done economically. It further puts the learner to work with his hands at the proper age, when his hands, his mind and his muscles can be developed and molded. He can be taught the rudiments of his chosen trade, such as the care and use of tools. He can be taught the necessary technical things, such as mathematics, drawing, etc.

The employer is not interested in having these boys kept at intensive training when they are young. He wants them to learn other things that will make life more pleasant and agreeable, outside of their working hours. But he does feel that a few hours a week under a practical instructor, who has learned his trade in a shop or building, and has actually made a living at his vocation, can be of tremendous benefit to the boy. He would like to see the boy employed in a way where a large percentage of his time could be used to plant the seed for further educational and cultural development.

Practical Instructions

The employer knows full well that a finished artisan cannot be prepared in any school. He must acquire the production knowledge either at the shop or at a building. He also knows that he must be in the hands of a practical instructor. The practical instructor can teach this boy many things aside from the pure mechanical operation of the use of tools and shop work. He can teach him trade pride and trade tradition. He can teach him appreciation for fine workmanship. He can teach him a vocational and trade consciousness, and he can point out to him that just sufficient knowledge to get by is not enough; that it is unfair to his brother craftsman to hold them down when the general wage level is based on the ability of the poorest workman. We know that a poor workman is a parasite on the good mechanic's ability. We can develop a trade consciousness in the industries and a set of craftsmen who not only have a Union, but also a trade.

The employer is particularly interested in eliminating waste. Aside from the reason of being unable to pay as high a wage as the unskilled producer is able to get at the beginning, those who employ skilled artisans are confronted with an additional expense, and that is the so-called mortality of apprentices under the present system. Boys come to us all enthused, want to learn, and, in a very short period, fall by the wayside for one reason or another. It is hard on any industry to have only twenty per cent of their learners graduate into journeymanship. It is for that reason that the employer would like to see a sort of cycle school or vocational determining period of some kind installed in the public school.

An address delivered before the conference of the Vocational Educational Association of the Middle West, Feb. 12, held at the Hotel Sherman, Chicago.

What Modern Machine Tools Are Doing

Gould & Eberhardt Manufacturing Hobbing-Machine

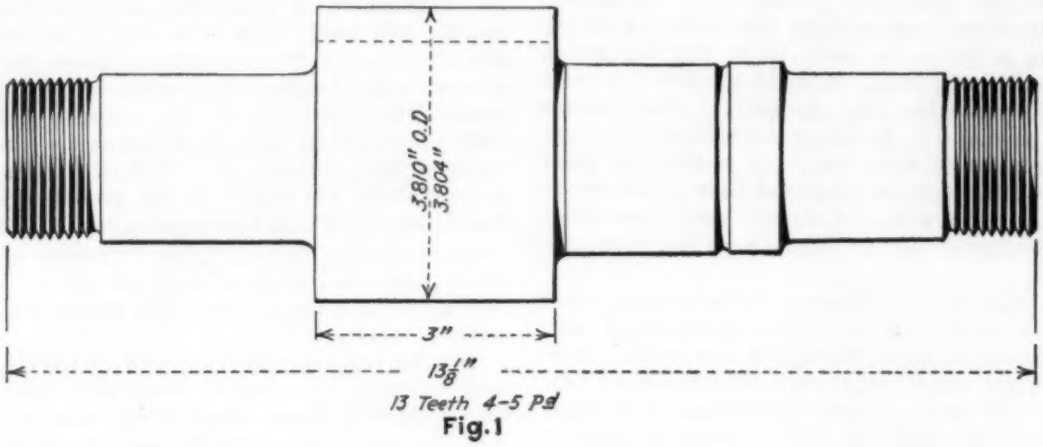


Fig. 1

Fig. 1—Double-reduction pinion shaft: 13 *teeth,* 4/5 *diametral pitch,* 20*-deg. pressure angle. Drop-forged steel,* 3½*-per cent nickel. Finished in one cut for grinding,* 1 *pinion per setting. Production,* 7.4 *per hour.*

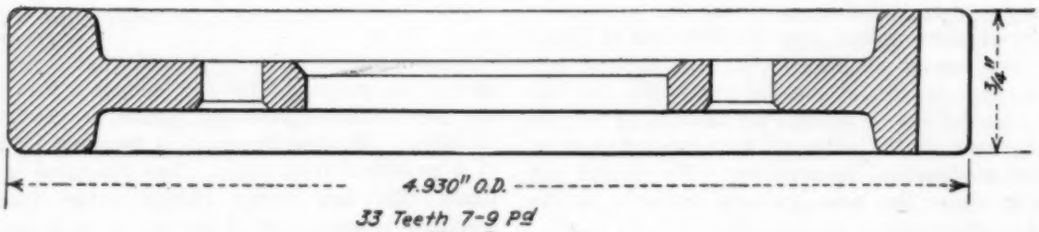


Fig. 2

Fig. 2—Transmission-countershaft drive-gear: 33 *teeth,* 7/9 *diametral pitch,* 20*-deg. pressure angle. Drop-forged steel. Roughed,* 12 *gears per setting, with double-thread hooked hob,* 4 *in. in diameter used in five positions.* 500 *gears per sharpening. Production,* 62 *per hour.*

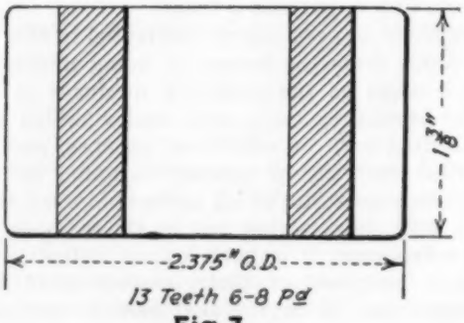


Fig. 3

Fig. 3—Transmission pinion: 13 *teeth,* 6/8 *diametral pitch,* 20*-deg. pressure angle. Hot-rolled steel. Finished after roughing,* 4 *pinions per setting, with* 4¼*-in. diameter hob.* 400 *gears per sharpening.* 3,000 *pinions cut on a test with* 100 *per cent inspection. Production,* 34 *per hour.*

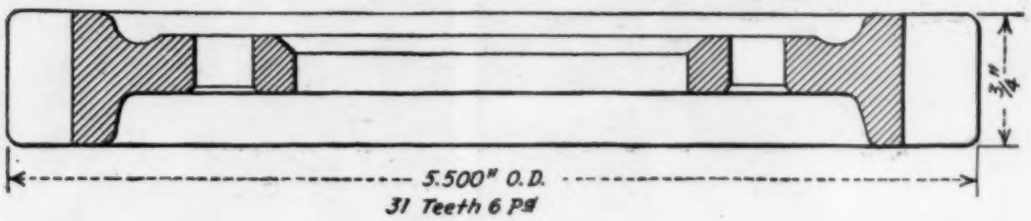


Fig. 4

Fig. 4—Transmission drive-gear for jackshaft: 31 *teeth,* 6 *diametral pitch,* 20-*deg. pressure angle. S.A.E.* 3250. *Finished one cut for grinding,* 12 *gears per setting, with* 4½*-in. diameter hob used in three positions.* 96 *gears per sharpening. Production,* 24 *per hour.*

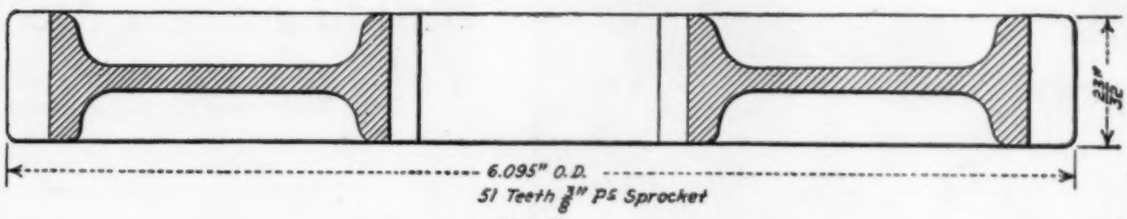


Fig. 5

Fig. 5—Silent-chain, starter sprocket: 51 *teeth,* ⅜*-in. circular pitch. Drop-forged steel. Finished one cut,* 12 *sprockets per setting. Production,* 13 *per hour.*

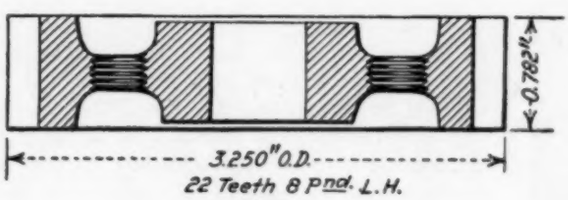


Fig. 6

Fig. 6—Timing gear: 22 *teeth,* 8 *normal diametral-pitch,* 23 *deg.,* 34 *min., left-hand. Hot-rolled steel. Roughed,* 8 *gears per setting, with triple-thread hob. Finished with single-thread hob. Production, roughing,* 98 *per hr.; finishing,* 37 *per hour.*

Fig. 7—Transmission-reverse idler gear: 16 *teeth,* 6 *diametral pitch,* 20-*deg. pressure angle. S.A.E.* 3250. *Finished one cut for grinding,* 4 *gears per setting, with* 4½*-in. diameter hob used in five positions.* 120 *gears per sharpening. Production,* 25 *per hour.*

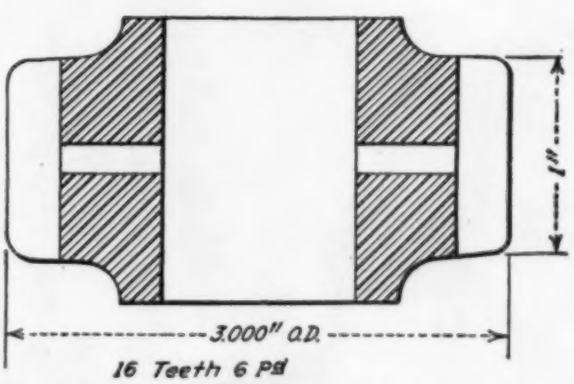
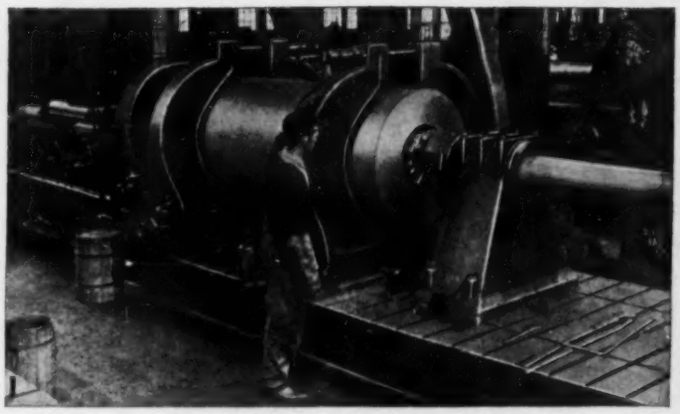
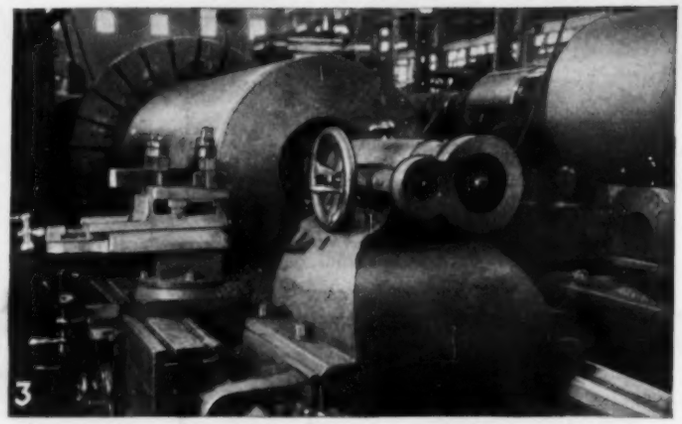


Fig. 7



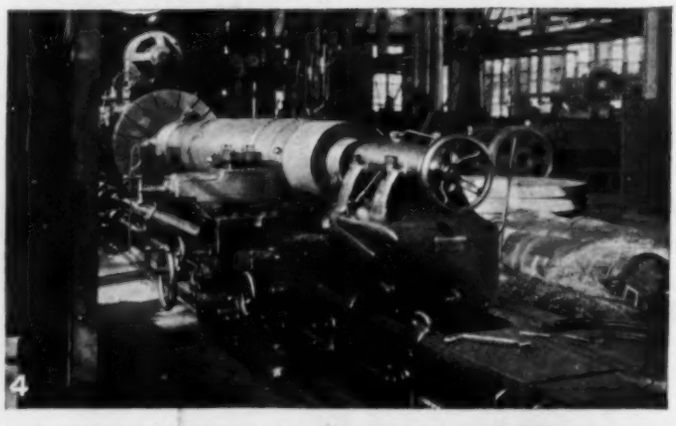


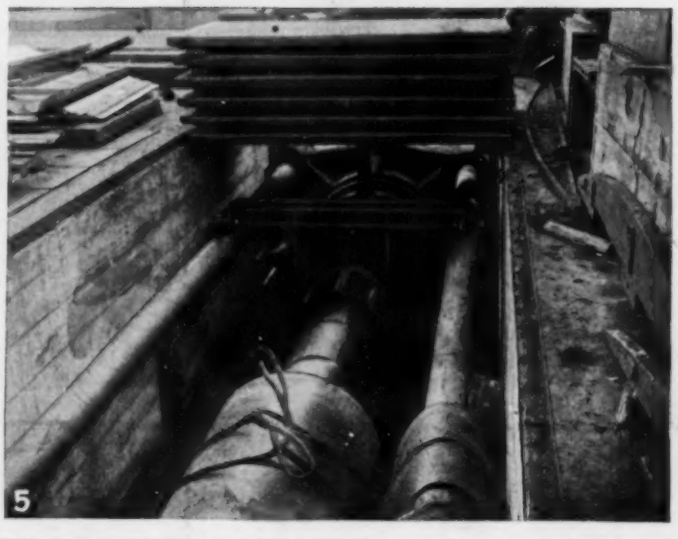
Building Sugar Machinery

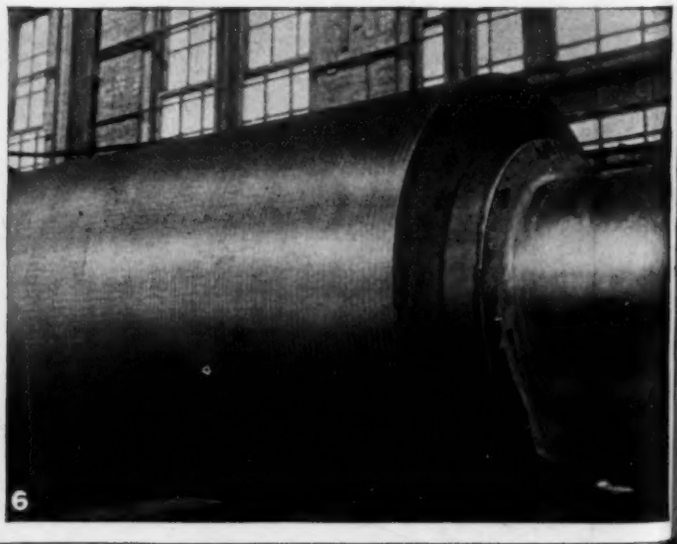
THE building of machinery for sugar mills necessitates the use of very heavy machinery and the work is, therefore, confined to a comparatively few shops. Well known among these is the plant of the Farrel Foundry at Waterbury, Conn., through the courtesy of which the accompanying photographs were secured.

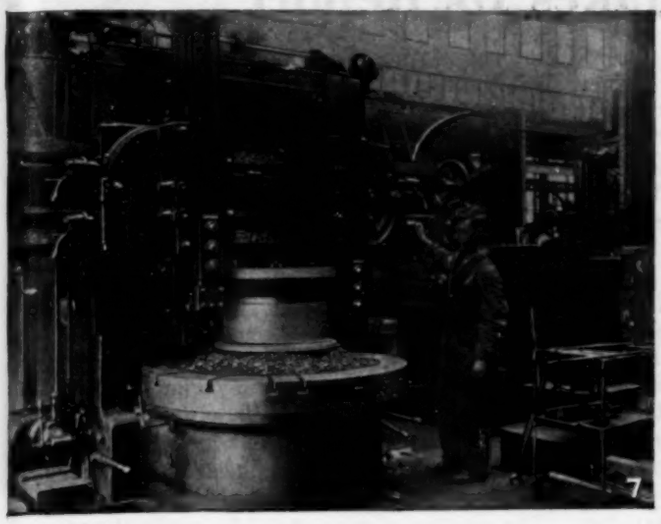
The rolls are hollow with shafts pressed in to form bearings on each end. Fig. 1 shows the boring bar starting through the roll and in Fig. 2, on one machine, the bar is half through while on the other the boring is about finished. The rolls are 38 in. in diameter and 92 in. long. With the shaft they weight 10¼ tons.

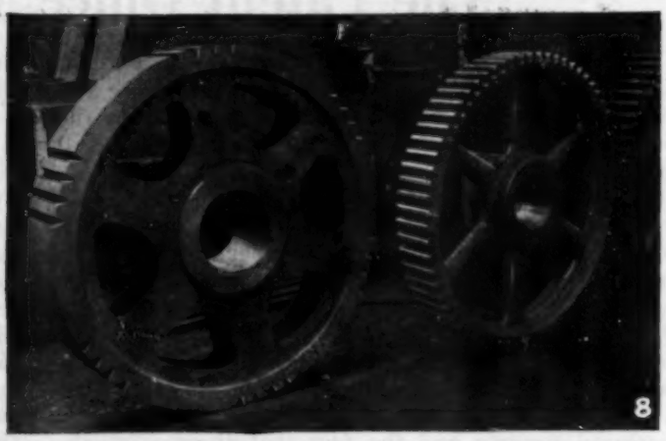
For rough turning, the roll is held on spiders as in Fig. 3, while in Fig. 4 the roll is being finish turned with the shaft in place. Fig. 5 shows how the shaft is pressed into the roll. This work is done with a hydraulic press sunk in a pit. The end of the ram is carried on the trolley *A*. Planks which close the opening over the pit, are shown piled up at *B*. Some of the crushing rolls have corrugations turned in the surface as shown in Fig. 6. Fig. 7 shows one of the bearings

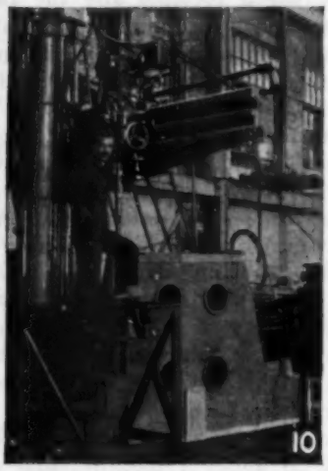












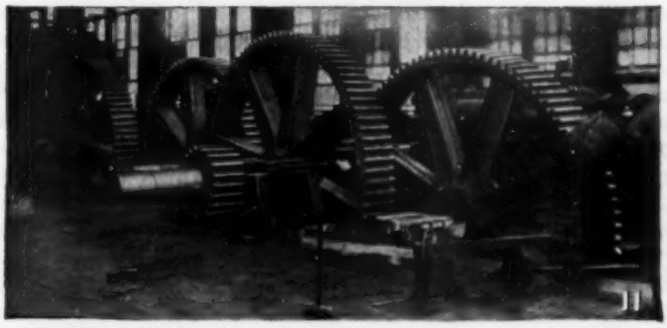
in the Farrel Foundry

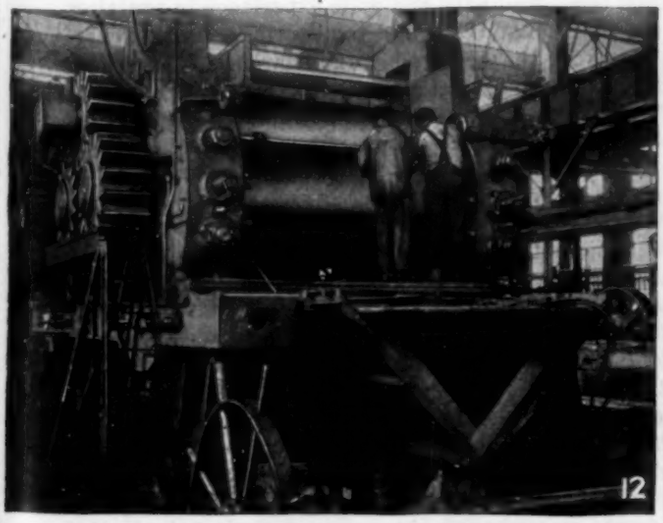
for the shaft of a roll being turned on a boring mill.

Some of the cast-iron gears used are shown in Fig. 8. The gear at the left shows the method of casting "rudimentary" teeth over each spoke, which has been found to relieve shrinkage strains. Without this precaution the spokes are apt to pull away from the rim in cooling. The only disadvantage is that the gear must be so set on the machine that the cast teeth and the hob or cutter coincide. A large job on a small machine is to be seen in Fig. 9 where a keyway is being cut in a large, cast pinion. More evidence of the size of the parts used in sugar mill machinery can be had from Fig. 10, which shows some drilling work on a mill gear pedestal.

The gearing to be seen in Fig. 11 shows the heavy construction necessary. In Fig. 12 the pinions are shown in place together with the large bearing-caps on the side of each bearing. This illustration also shows how the three rolls are placed.

The general view of the erecting bay, Fig. 13, shows a set of rolls in which the erection is nearly completed, and other machinery distributed down the side.





The Patent Office Makes Its Report

TOTAL receipts for the United States Patent Office amounted to $3,176,622 during the calendar year of 1924, the largest of any year in the history of this Government agency, according to the report sent to Congress by the Secretary of the Interior.

The report points out that the office in its examination work is gaining at the rate of 2,000 applications per month and had reduced the number of applications awaiting official action by almost 12,000 during the year. The report in part is as follows:

"The past year has been one of unprecedented progress and gains in the Patent Office—101,134 applications of all kinds were received during the past year—2,738 more than the year before. Notwithstanding the increased receipts and the fact that there were also received 29,027 more amendments to applications than in the preceding year, the end of the year shows an actual reduction of nearly 12,000 applications awaiting official action. The increased output is also shown by the fact that the number of patent, design, and trade-mark applications finally allowed was 9,568 more than allowed during the previous year, while the total number of issued patents, designs, and trade-marks increased from 57,512 during 1923, to 63,062 during 1924, showing an actual increased output of 5,550.

"It is gratifying to state that the gains above noted have resulted in a reduction in the time an application must wait to receive official action. This may be seen from the fact that as compared with a year ago there are now 19 divisions instead of 3 under 5 months in arrears: 38 instead of 7 under 6 months; 48 instead of 30 under 7 months; and all 54 divisions are now under 8 months; whereas at the beginning of the year 20 divisions were over 8 months behind. In fact the average time an application now awaits official action has been reduced to 4½ months for new work, and between 3 and 4 months for old work. The examining corps is now gaining at the rate of 2,000 applications per month and has as its goal for the next three months to decrease by 30 days the time an application must wait for official action.

"The work in the design, patent and trademark divisions is under 30 days, as is also the work in the 10 clerical divisions.

"There are no cases awaiting decision by the Commissioner or either of the Assistant Commissioners which had been heard prior to Dec. 1, and the Board of Examiners-in-Chief (two years ago almost a year behind) is now only 6 weeks in deciding *ex-parte* cases and 2 months in interference cases.

Additional Revenue

"Owing partially to the fact that Congress increased the filing fee from $15 to $20 for each patent application, thus bringing in an additional $400,000 in fees, the total receipts during the year were larger than ever before in this history of the Patent Office, amounting to $3,176,622.56. However, Congress has also increased the personnel to permit the office to gain upon the arrears of past years and has also passed the classification act raising the salaries, so that the expenditures for the past year have amounted to $3,561,395.10, the excess of expenditures over the receipts amounting to $408,602.13, against which should be credited hundreds of thousands of printed copies of patents by which the salable stock of patents has been increased. Deducting this deficit from the total surplus of past years leaves a net surplus of $7,932,738.82.

"On July 1 last, the Public Buildings Commission placed at the disposal of the Patent Office over 20,000 sq.ft. of space in the Old Land Office Building across the street from the Patent Office and connected with it by a tunnel. (About 10 more rooms have been assigned to the Patent Office, but have not yet been actually transferred.) This additional space has permitted a thorough reorganization of the office, making it possible to house 185 additional employees provided by Congress during the past two years, to locate the various related patent divisions in groups, and to completely reorganize the divisions so as to have the divisions more homogeneous and to locate related divisions near each other instead of being on opposite sides of the building as heretofore. The additional space has also made it possible to move the clerical divisions giving public service to the ground floor of the present building, on a level with the street, so that patrons of the office may do business with the Financial Clerk, the Mail Room, and the Copy Sales Division without using the elevators or even going beyond the street floor.

Search Room Improvements

"The public search room is also being reorganized and the new steel stacks provided therefor in the appropriation bill have been purchased and installed.

"The Secretary of the Interior has appointed a committee to study the conditions and methods in the Patent Office with the idea of aiding in still further efforts to devise and adopt means for simplifying the procedure and expediting the business. This committee is composed of representatives nominated by President Hughes of the American Bar Association, President Grant of the Chamber of Commerce of the United States, President Mason of the American Patent Law Association (the National Association of Patent Lawyers) and the presidents of the National Association of Manufacturers and the Patent Law Associations of Chicago, Cleveland, Detroit, Pittsburgh, New York, and Philadelphia, respectively. The members of the committee come from widely scattered industrial parts of the country and include those who have had wide experience in practices before the Patent Office and the courts, and also representatives of the big trade organizations, engineering societies, and manufacturers.

"Every opportunity and facility have been afforded this committee to make an entirely independent study of the Patent Office and it is believed the committee will soon make its reort to the secretary.

"The sale of printed copies of patents is increasing quite rapidly, thus during the past year the Patent Office sold 2,686,261 copies at 10 cents each, bringing in a revenue of $268,626.10 (exclusive of those which were sold to libraries and which were exchanged for foreign patents). In 1923 the office sold 2,464,261 copies; in 1922, 2,417,284; and in 1921, 2,209,693. Thus, the sale of printed copies in four years has increased by almost half a million copies. In addition to those that were sold for 10 cents each, 680,934 copies were sent to public libraries, and 1,099,301 were shipped to foreign Governernments in exchange for copies of their patents that would otherwise have cost the office about $70,000."

Automotive Production

The Manufacture of Sleeve Valve Engines

By John Younger
Associate Editor, *American Machinist*

Machining sleeves 3/32 in. in thickness — Lapping or honing operations described—Operations on the aluminum piston — Means taken to insure great accuracy

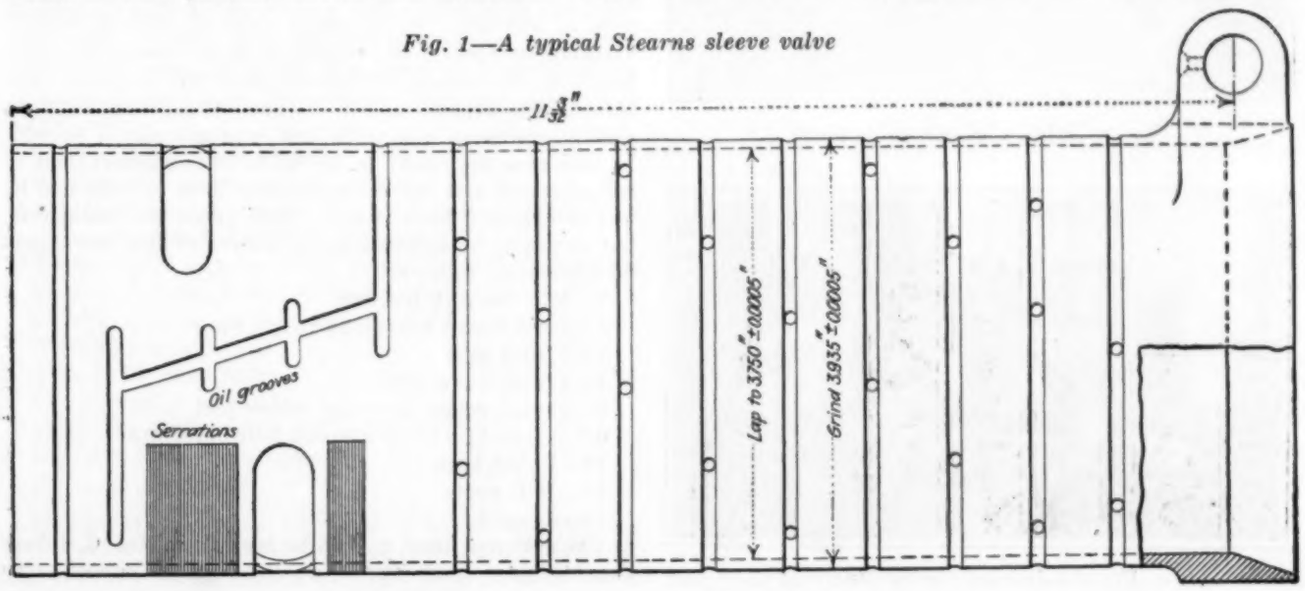
THE F. B. Stearns Co., of Cleveland, has been making automobiles with Knight sleeve-valve engines for over fourteen years. In this type of engine no poppet valves are used but instead there are two concentric sleeves in each cylinder, each sleeve having a port for the intake of the gas and one for the exhaust. Both sleeves reciprocate vertically inside the cylinder, being driven by what is virtually a small crankshaft, and the piston reciprocates inside the inner sleeve. As the clearances between the respective sliding surfaces are only 0.003 in. the need for great accuracy both dimensionally and in shape is apparent.

Interest naturally centers around the sleeves which are the most important factors. These, as shown in Fig. 1, are of close-grained gray cast iron of high grade, free from porosity. As will be noticed, the thickness of the sleeve illustrated is only $\frac{3}{32}$ in., although another of the sleeves used is $\frac{1}{4}$ in. thick and 13 in. long. The total tolerance allowed in the bore and outside diameter is 0.001 in. A process of selection into three sizes is followed with pistons, sleeves and cylinders, to get accurate and economical results. The routing of operations on both sleeves is as follows:

1—Chamfer and face
2—Turn and mill lug (Fig. 2)
3—Turn clearance in lug
4—Mill the ports (Fig. 3)
5—Anneal
6—Rough grind
7—Grind outside and ream
8-9—Turn and mill oil grooves
10—Drill oil holes in barrels
11—Ream and lap (or hone)
12-13—Drill small holes
14—Finish grind
15—Mill clearance between ports
16—Serrate or score
17—Turn clearance
18—Hand ream pin hole and file off whiskers

Operation No. 5, annealing, is a most important one. The sleeves are put in a furnace and held at a temperature of 700 to 800 deg. F. for some 4 hours and then

Fig. 1—A typical Stearns sleeve valve



AUTOMOTIVE PRODUCTION

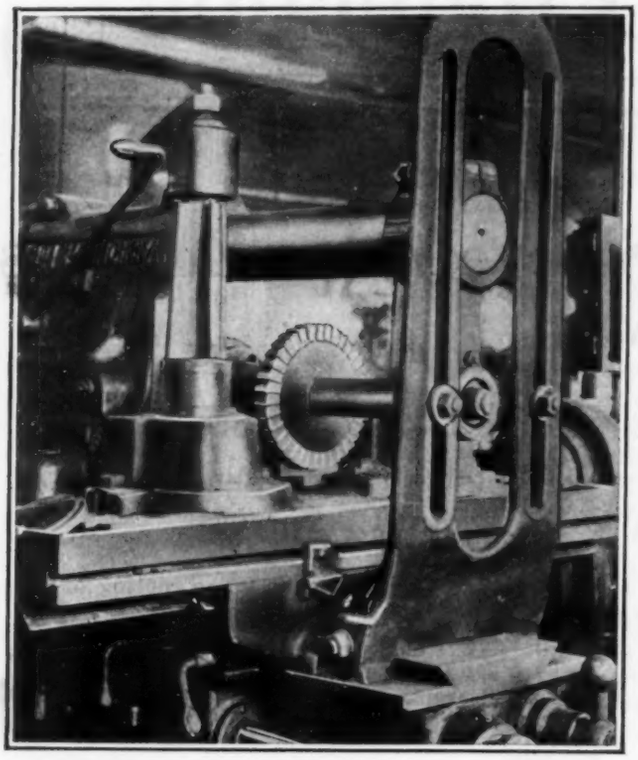


Fig. 2—Milling a slot in the lug of a sleeve valve with special fixture

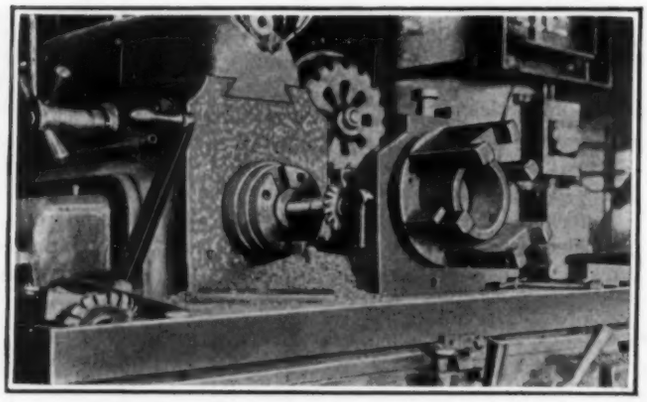


Fig. 3—Milling sleeve valve ports

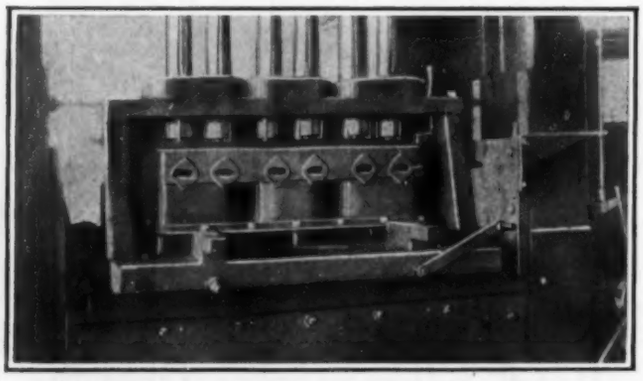


Fig. 5—Boring the cylinders

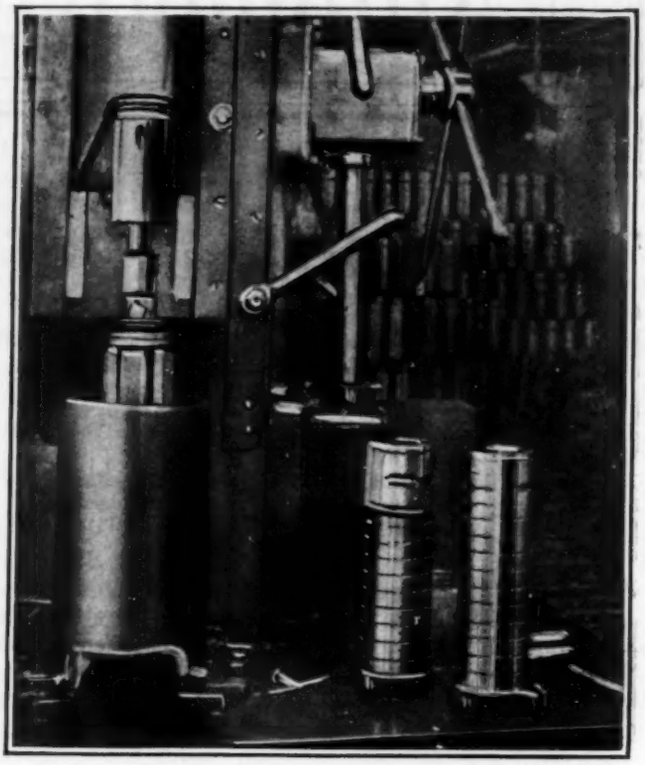


Fig. 4—Lapping the inside of a sleeve

allowed to cool overnight in the furnace. This operation seems to stabilize the internal structure of the sleeves so that they take a permanent set and undergo no other distortion even under the heat of the cylinder during action.

The honing operation, No. 11, Fig. 4, is done with a Titan Machine Co.'s hone to the limits stated above in some two or three minutes, producing an exceedingly smooth, accurate bore.

The serrations or scores on the outside of the outer sleeve above and below the exhaust port in Fig. 1 are made in operation No. 16. The reason for their presence is unusual. In the early days of Knight motors extreme accuracy was thought to be necessary and carbon was dreaded. Experience showed, however, that the carbon deposit helped to keep the joints between sliding members gas tight and was actually a benefit. In this case the sleeve is scored to encourage carbon to collect above and below the exhaust port to help seal it.

The cylinder block varies little from the usual one, but it might be interesting to glance at the operations which are as follows:

1—Mill top and bottom
2—Drill flange holes and rough bore
3—Finish mill
4—Finish bore (Fig. 5)
5—Finish ream, bore and water test
6-7-8-9-10-11—Drill various holes and stud
12—Grind bore
13—Mill ports
14—Inspect

The cylinder head, as will be seen from Fig. 6, differs considerably from the type used in a poppet-valve

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engine. It is of close-grained gray cast iron and is finished as follows:

1—Anneal
2—Sand blast
3-4—Finish all over
5—Tap spark plug hole

The upper threaded portion projects through the cover over the engine. A nut screwed on each head holds the cover in place. The lower domed portion forms part of the combustion chamber for the gases.

The Bu-Nite piston used is made of nickel aluminum alloy and is fitted with two steel bands, one at the bottom of the skirt and the other midway between the top of the piston and the axis of the piston pin. The piston itself also has a wave-like slot extending from

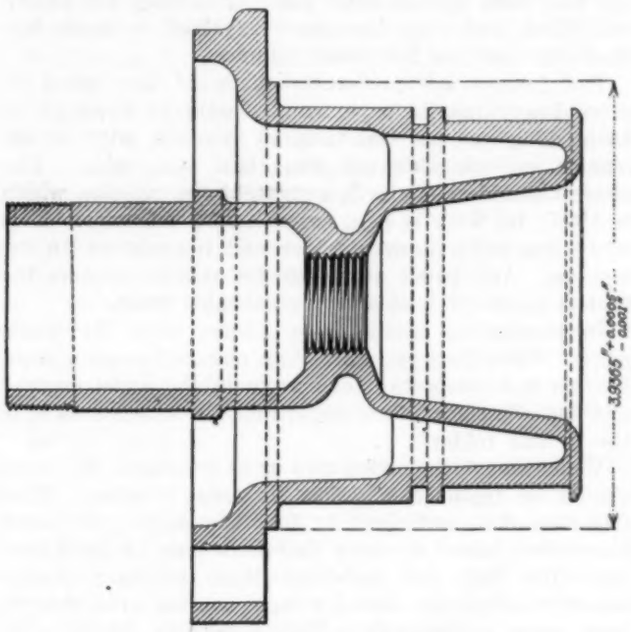

Fig. 6—Cylinder head section

the lowest piston ring groove to the bottom of the skirt. By reason of this it is possible to machine the piston to have the same clearance as a cast-iron piston and use it successfully inside the sleeves. The operations are as follows:

1—Rough turn and groove
2—Mill saw slots
3—Heat-treat to break the bond between the steel bands and the aluminum piston
4—Bore and face open end, centering at the same time
5—Finish turn, undercut and chamfer
6—Finish ring grooves and turn oil grooves
7—Rough grind O. D.
8-9—Drill small holes
10—Finish grind O. D.
11-12-13—Drill piston-pin holes
14—Hand ream pin holes
15—Lap pin holes

In operation No. 4, which is done on a universal screw machine, the hollow spindle is fitted with a bushing through which passes a center drill actuated by a

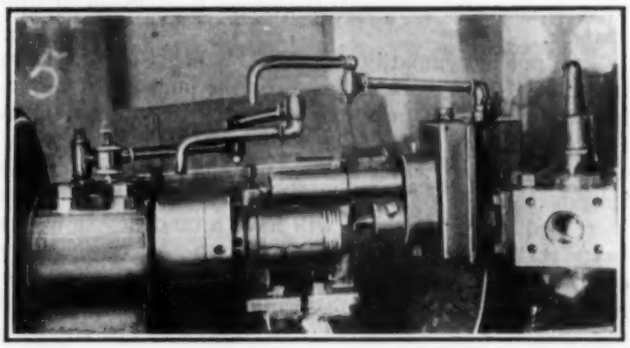

Fig. 7—Roller steady used in finish turning piston

feed lever. The piston is thus centered at the top while being turned.

In operation No. 6, illustrated in Fig. 9, it has been found that greater accuracy has resulted by having a rolling steady rest on top of the piston as shown.

Crankshafts for 8-in-Line Motors—Discussion

By Newton Carr

Frank C. Hudson, in writing of the crankshaft difficulties of the 8-in-line motor on page 232, Vol. 62, of the *American Machinist* seems to me to be drawing upon his imagination for most of his troubles.

To take up his objections in the order that they are stated, I cannot conceive why it should be more difficult to maintain eight boring bars or reamers to exact size than six—or, for that matter, one—except that it would require more time. In the matter of overhanging machine tables, unless in case of machinery expressly designed to handle six blocks, there is little likelihood of exceeding their capacity, and in any case a machine built or purchased to handle one kind of product cannot be expected to adapt itself to another.

The crankshaft presents other problems, not additional difficulties, to the tool engineer. It cannot be expected that an eight-throw shaft can be put into the same machines and fixtures as now handle the sixes, without alteration. The tools must be designed to suit the product, but no real tool engineer is going to consider that a hardship. It is just that condition that justifies his existence.

Again, is the torsional strain upon an eight-throw crankshaft excessively greater than that upon a six, assuming the motors to be of the same power? And if so, why? Torsional strain is the effect of moment directly applied, and this moment is individually less as well as more widely distributed both as to time and place in the eight than in the six.

The eight-throw crankshaft affords better facilities for balancing than the six and can reasonably be expected to produce smoother running as well as more uniform torque, both of which should be reflected in better performance and longer life of connected parts. It may also have an appreciable effect upon the wearing qualities of rear tires, for it is a generally accepted fact that the tires of a two-cylinder steam driven car

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wear longer and give better service than those of any gas car.

I am not in sympathy with that "school" of engineers who design heavy crankshafts for the purpose of reducing the number of bearings necessary to support them. I believe it to be far better to support the thrust of the pistons in as nearly a direct line as possible, and the introduction of more bearings made necessary by the increased length of shaft, will have a tendency to lessen bearing troubles by distributing the stresses more evenly. If a shaft supported by a multiplicity of bearings "weaves, carrying the crankcase with it" I should say that it was the designer of the case, not the case itself, that needed investigation.

I am exceedingly skeptical—as I think Mr. Hudson is also—of the 18-deg. twist in the length of a six- or even an eight-throw crankshaft. Eighteen degrees is not so much when measured on the circumference of a pie, but I think it is quite enough to be noticeable in the exhaust of a smoothly purring eight-cylinder motor.

I believe that the 8-in-line motor will have a longer life and show better performance mechanically than the six, if it is properly designed, but I am sure that it will consume more fuel to the unit of power delivered. When I was negotiating for the purchase of the wreck that I am now driving I objected on the ground that it would be a "gas-eater," but the urbane salesman assured me that such was not the case.

After he had trundled me around for sixty or eighty miles in an afternoon, I asked him how much gas we had used, and when he had taken a look at the gage he averred that he could not see that we had used any. If he was right (incidentally, I think he is a liar) the final objection to the eight-cylindered car is removed.

How Better the Archives—Discussion

By G. W. Drake

Regarding the editorial on the contents page, No. 2, Vol. 62 of the *American Machinist* entitled, "How Better the Archives," in which you agree with a reader, whom you quote, that the best way of filing the *American Machinist* articles is to file the complete volume. Allow me to point out a few of the disadvantages of such a method.

1—The expense of having the volumes bound, and then the expense of a book case to keep them in.

2—The space required for the volumes, two each year.

3—The time spent in looking up a subject when many volumes have to be consulted.

4—The method does not take care of the many circulars, memoranda, patent papers, Government pamphlets, etc., that accumulate.

The writer has for many years filed articles clipped from technical papers in folders, that are filed in vertical filing drawers, such as are commonly used in offices.

This system has been found very satisfactory because of its flexibility and efficiency. It takes care of all kinds of data and requires very little time to keep it up.

When quite a number of technical papers have accumulated, the different articles in the reading matter are separated from each other, and those that are to be saved are filed away in the proper folders, a folder being provided for each subject or subdivision of a subject.

The data on any one subject can be kept in one folder or as many folders as desired. Data that become obsolete can be thrown away. All the data on any subject are always available at a moment's notice. There is no necessity for throwing away data "that may be wanted tomorrow" as with this system it is just as easy to keep them as to throw them away. With 100 folders to start with, practically all subjects that the average designer may want may be filed away.

A Saving of Space

One hundred folders may seem like a good many, but they take up but little space until they are pretty well filled, and then the space required is much less than that required for bound volumes.

The folders are preferably made of tag board or extra heavy manila paper, and should be from 14 to 15 in. long and not less than 10 in. wide, with an extension on one side not less than ¾-in. wide. The nearest commercial size is a straight cut cap size, which is 15x9½ in. with a ½-in. extension on one side. This is a little too narrow a folder and too narrow an extension. Any paper store will be able to furnish the folders as specified at a very reasonable price.

In separating the articles always save the whole page. When there is more than one article on a page, file the most important one away in the usual manner and file a memorandum regarding the other article in the proper folder.

When an article covers two or more pages, the pages should be fastened together in some manner. When clipping, it is sufficient to fold the pages over upon themselves once, or paper fasteners may be used temporarily. But for fastening them together permanently transparent adhesive tape, one in. wide, may be used very successfully. This comes in 50-yd. rolls. The tape should be applied lengthwise along the two edges of the two sheets to be fastened together. A third sheet can then be fastened to the second sheet, etc., until as many are fastened together as desired. This makes a very durable and efficient binding, and, although it takes some time, it is worth while. It is a good plan to print or stamp on each clipping a request that clipping be returned, as clippings when loaned are not always returned.

The Evolution of the Present Filing System

The writer has been saving articles from the technical papers thirty-five years or more. They were at first pasted into scrap books which were after a few years abandoned in favor of shallow pasteboard boxes, 15x10x¾ in. deep, one hundred or more being used. These were kept in a specially designed cabinet having a compartment for each box. This was a very satisfactory system in many ways. But as the boxes were rather expensive and not very durable and required a special filing cabinet they were finally abandoned for the folders filed in vertical filing drawers. This system has now been in use for over fifteen years and I find it satisfactory and the data thus accumulated valuable.

Is the Skilled Mechanic Passing?

By M. E. Carr

HAS the factory system resulted in the passing of the skilled mechanic, or has he been carried along by the tide of indifference that has swept over the ranks of the workingman?

It may be that he is unconsciously resenting the loss of his individuality, for it is true that many operations that formerly required the services of a highly skilled mechanic have been subdivided in the factories into minute parts, each of which is performed by an operative in mechanical routine, measurable in speed alone.

The old-time mechanic regretfully harks back to the good old days and is shocked by the irresponsible workman of today.

We received a letter recently from a mechanic of the old school, who says that theories and book science of mechanics continue to progress, but personal skill of mechanics is declining; that the decline in the past twenty years is distinctly noticeable.

He says this is due, no doubt, to the specializing effect of machinery, and the class gap between employer and employee, dulling the aspirations of workers to improve themselves beyond the irreducible minimum.

"As old-time mechanics pass away," he says, "and the new generation replaces them, breeding downward instead of upward takes place.

"Men with ambition enough and energy enough to improve their mind and condition become executives, and there is not enough brains to go around to leaven the ranks of the workers. Yes, the executives plan the processes, but they cannot carry them out as planned 100 per cent.

"The workers do not possess the mechanical skill, apparently. Let me prove it in our own case. We sell a plant some tools. While new we hear slight complaint, comparatively. Just as soon as chasers get dull or tools need repair, do the men often put them in condition again? Oh, no; most of them holler their heads off: 'Tools and chasers no good.'

"What's the matter? If they were old-time mechanics like those who were in the ranks twenty-five years ago—and I was there, I know—the man would find out what was the matter and fix it up or lose his job.

"Today the man is not even criticised by his employer."

Such is the opinion of a mechanic of the earlier days.

Present-Day Workmen

On the other hand, it is contended that the factory system, in which each operator repeats indefinitely a single task, requires and creates a lower grade of intelligence among workingmen than the old system under which the laborer knew the whole of his trade; that the man who works in the modern factory, feeding an automatic machine, does not need and will not have the mental vision of the old-time mechanic.

To accomplish the work at hand he does not need the mental vision of the mechanic of the past, and he, with few exceptions, will not have it because it is always easier to drift with the tide than to push forward against it.

It is easier to do as the sportsman who was known to be a very poor shot. He invited a number of friends to dinner, and after dinner showed his guests a target painted on a high fence, with a bullet directly in the center of the bull's-eye. This he declared he shot at a distance of 1,000 yards.

His statement was accepted as a good joke, and then he offered to bet new hats for the crowd on it.

One of the party accepted the wager. The sportsman was able to produce two men, well known to the others and whose word they would not doubt. They both readily stated that he had done what he claimed.

New England Has Changed

On many streams in New England there once was a saw or grist mill every few miles. Abandoned for more than a half century, the wood cribwork of the dams has given way and permitted the streams to resume their natural levels.

It was the splendid water power offered that promoted the industrial growth of New England.

At the time of the introduction of automatic machinery only water power was available to drive the machinery; hence the operator must locate his factory, not at some important industrial center, but at a spot where sufficient supply of water power was available.

The factory system originated in England. In 1769 Arkwright set up his first mill, driven by horses, and took out a patent for his invention. Two years later he set up a larger factory, with water power. From these Arkwright mills the present day factory system takes its origin.

There followed a remarkable series of inventions, by which automatic machinery was introduced, supplementing hand labor in the manufacture of cotton and woolen cloth. With these inventions are identified the names of Arkwright, Hargraves, Cartwright, Crompton.

A labor-saving machine was regarded as an enemy of the workingman, and, as someone has said, an inventor had to be a hero as well as a genius. The fate of such men was almost certain persecution and poverty.

England jealously guarded the secrets of her great machines, but Destiny held in her hand the great factories of today, and it was not long before a factory was built at Pawtucket, R. I., and from that time the factory system developed in America and throughout Europe, and extended to all branches of industry.

The steps in the development of the modern factory system have been the invention of automatic machinery, the application of steam as a motive force to drive the machinery, the introduction of the steamship and the railway, the development of the patent system, whereby it became possible for a man not only to benefit others, but to receive a comfortable compensation for his inventions.

Electricity is now proving an economical and convenient substitute for steam, and seems likely to do away with much of the cumbersome shafting and belting by means of which power is distributed through the ordinary factory.

An American economist, Edward Atkinson, prophesied that the use of electric power, so easily transmitted and applied, will finally result in the dispersion to their

Reprinted from the February issue of *Threads* published by the Geometric Tool Co., New Haven, Conn.

own homes of the multitude of workers now gathered in factories, and that the weaver will work at his own loom and the spinner at his spindle in his own cottage, and a new form of power-driven household industry will supplant the factory system.

With the whole trend of modern industry towards a still greater centralization of capital and of labor, the realization of Atkinson's prophecy would belong to a most remote future.

As the use of automatic machinery has increased, physical comfort has increased. If life should become every way easy, we should degenerate into human dough from which the yeast had been omitted.

Machines, wonderful as they may be, were created by man. Man was created by God. The possibilities of the machine are limited to the finite mind. The possibilities of the man are unlimited through the Infinite Mind.

What chance of improvement has a man who, day in and day out, from the rising of the sun even to the going down of the same, inserts and removes from an automatic machine the same unite of manufacture?

If that is all he is doing, he has no chance. He will become only the human part of the man-created machine. But he was created by the Eternal and Infinite Spirit, the Creator and Sovereign of the Universe, and that Creator has given him access to the mental vision.

While his hands are busy with the mechanical action, his mental vision may be as unlimited as he chooses. Given encouragement, that vision will search out of him a higher plane of action.

God never wastes any material.

Book Reviews

"Mechanical World" Electrical Pocket Book, 1925. Three hundred and twenty-six pages, 4x6 in., together with a diary in the back. Board covers. Illustrated. Published by Emmott & Co., Limited, 65 King St., Manchester, England. Price 1 shilling sixpence, net.

This book is an annual publication containing a collection of electrical engineering notes, rules, tables and data.

Among the additions to the 1925 edition are sections dealing with primary cells; up-to-date methods of testing generators, motors and transformers; electrical supply systems; x-rays; and storage batteries for automobiles.

Other sections have been revised where necessary and new illustrations introduced.

Magnets. By Charles R. Underhill. Four hundred and sixty-eight pages, 467 illustrations. Published by the McGraw-Hill Book Co., Inc., 70 Seventh Ave., New York City. Price, $4.

After a broad treatment of the general principles of apparatus electro-magnetically operated and controlled, the author treats in detail of electro-magnets and permanent magnets. The materials composing the structures of magnets, the relative physical dimensions of the various parts and the phenomena associated with them are carefully considered. Since electric motors and other electro-magnetic devices to be controlled are operated from both alternating- and direct-current circuits, these general circuits and their characteristics are explained.

Equations have been used as sparingly as possible, the mathematical deductions having been translated into the text with the law of conservation of energy as a basis and the mathematics then eliminated. Numerous examples are worked out to illustrate the subject matter. It is shown that alternating-current electro-magnets are almost as easily designed as are direct-current electro-magnets when the magnetic flux, due to the electric current, is separated from the magnetic flux inherent to the magnetic material.

The Science of Marketing by Mail. By Homer J. Buckley, president Buckley, Dement & Co., Chicago. Three hundred and twenty-three pages, 5x8 in. Cloth boards. Published by the B. C. Forbes Publishing Co., 120 Fifth Ave., New York City. Price $2.

Statements of many basic advertising principles are contained in this book and their clear presentation will help any reader toward a true conception of the possibilities in and limitations of marketing by mail.

There are numerous examples of selling by mail and for the most part they deal with products that are finally purchased and used or consumed by the individual, usually over the counter or in stores, all of which is logical since it is in the sale of such products that the method treated has its greatest field. Exceptions are such products as addressing machines, cash registers and furnaces.

Emphasis is given to the assistance to the salesman of selling by mail in his contact with jobber and dealer and to its success in replacing the salesman in remote places and small towns. Its value in keeping customers sold also is treated.

The importance of costs is pointed out and some very true statements are made about the value of truth in advertising.

Bound into the book is a "test chart" for preparing mail advertising. It enumerates the points to be considered from the proposition, the first thing to be considered, through the steps of working out the plan and preparing the copy.

Personnel Administration—A Bibliography. Compiled by William H. Rossi and Diana I. Powers Rossi. Three hundred and thirty-six pages, 6x9 in., cloth boards. Published by the Williams & Wilkins Co., Baltimore, Md. Price $5.

With the growing recognition of the place proper personnel administration has in industry, this bibliography is of real importance. It assembles, in a form that is easily read and easily used, references by title and author to articles that have been difficult of access on account of being scattered in a great many publications.

Only the period from 1919 to Jan. 1, 1924, is covered, and while the book makes no claim to completeness, it will be realized that many of the most important contributions to personnel literature were made during that time. The articles are selected, only the most noteworthy contributions to the subject, according to the conception of the compilers, having been included.

About 2,750 titles are listed, under the headings personnel administration, employment, health and safety, education and training, research, employee service, rewards, administrative correlation and joint relations. There are indexes of periodicals and authors.

The compilers contemplate keeping the study up to date by supplements to be published annually.

Kinks in a Railroad Blacksmith Shop

By Jack Williams

A use for discarded air-brake cylinders—Many small parts forged on home-made machines—Machines built without castings or machine work

THERE is always plenty to do around a railroad blacksmith shop, and any device or appliance that will help the blacksmith to get out more work in a day or that will render his task less arduous should be of interest, especially if it is something that can be built in the shop from material already to hand. The devices here shown are of that kind, being built by the blacksmiths with very little help from the machine shop. They are evolved from the fertile brain of John McDonald, foreman blacksmith of the Portland Terminal R.R. shops at Portland, Maine.

Discarded air-brake cylinders around a railroad repair shop are—to paraphrase a well-known popular writer—"about the plentiest thing there is of," and the devices here described are all built around one or more such cylinders. The frames are made mostly of structural shapes and of forgings from flat bar stock, bolted and riveted together. About the only machine work required, aside from fitting up the cylinders, was to drill the bolt and rivet holes; and in many cases these were punched in the hot stock during the forging operation.

The largest and most complicated of the devices, shown in Fig. 1, is a compound or double-action bending machine that does the work of a regular bulldozer. Two I-beams form the base of the machine and the remainder is made up of forgings and pieces of bar stock. A wide, flat plate of iron joins the I-beams together at one end and provides a table, or die-bed, to which the forming and bending dies are bolted.

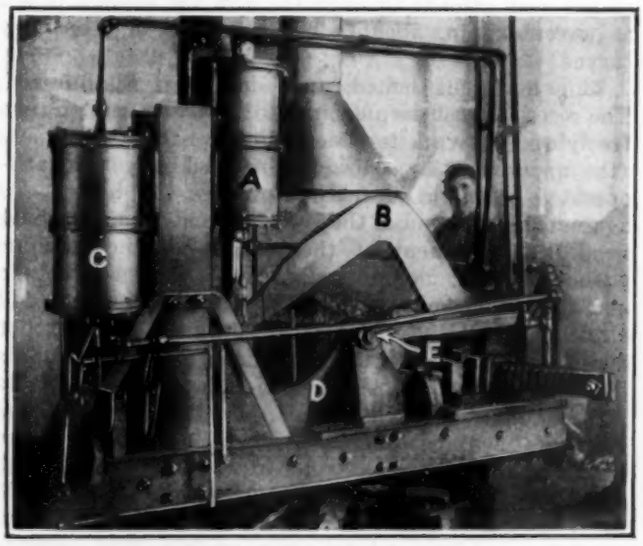


Fig. 1—Double-action pneumatic bending machine

Two cylinders, each made up of two air-brake cylinders bolted together in tandem, constitute the actuating mechanism. The movement of the pistons is controlled by means of the standard pressure and release valves that are used in connection with the air brake systems of railroad trains. The piston rod of cylinder *A* is connected to the long end of the lever *B*, which is fulcrumed at the opposite end and applies a downward pressure to the upper member of the pair of dies.

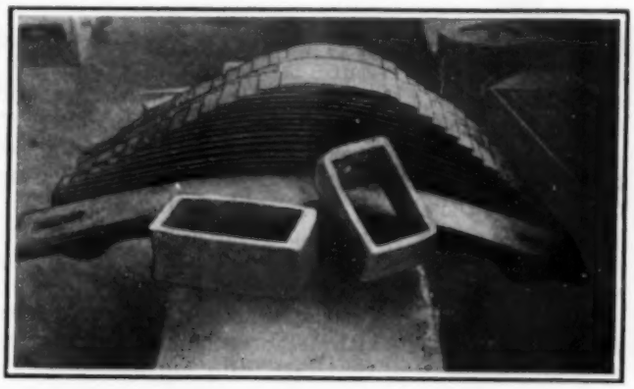


Fig. 2—Locomotive springs

The cylinder *C* is connected to the long end of the lever *D*, which is fulcrumed at *E* and the short end bent down at a right angle, so that the lever is a sort of bell-crank, and transforms the vertical movement of the piston to a horizontal movement of the plunger to which the punches are attached; corresponding to the gate of a bulldozer.

The machine is used for many purposes, among which are the making and applying of spring-bands, making coupler rivets, spring hangers, spring- and brake-hanger pins, sill steps and grab handles for freight cars, and many other parts that are in constant demand around locomotive and car shops. As shown in Fig. 1, it is set up to apply the bands to the elliptic springs upon which the greater part of the weight of a locomotive rests. Two of these springs and the bands that are to bind the leaves together may be seen in Fig. 2, ready for the operation.

In making the spring bands, a flat bar of iron is first drawn out by hand on an anvil, leaving the full size of the bar for a short distance in the middle and thinning down the stock both ways to the thickness required at the sides of the band. This straight piece is then reheated to forging heat, set into the machine and pushed by the punch into a die that draws it up into a square-bottomed, open-end strap, with sides long

enough so that they can be folded toward each other and welded together to form the band. The final closing and welding operation is done over a former at the forge.

To apply a band to the spring it is first heated to forging heat and slipped over the stack of leaves. The spring is then laid crosswise in the machine as shown in Fig. 1, a block of iron laid on the side of the band under the shoe of lever *B*, and other blocks placed

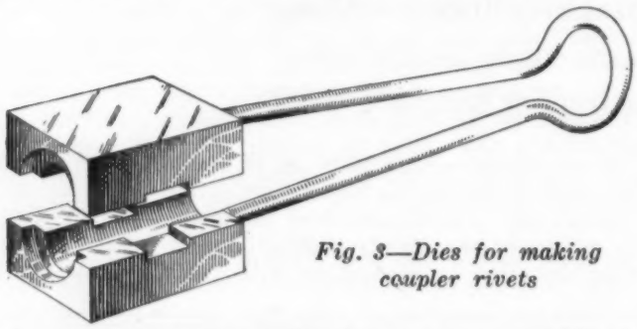


Fig. 3—Dies for making coupler rivets

between the end of the band and the shoe on the end of the plunger. Pressure is applied by cylinder *A*, squeezing the band tightly upon the spring leaves, and immediately followed with pressure by cylinder *C*, which causes the plunger to move forward and upset the sides of the band, at the same time compressing the leaves of the spring to their smallest compass. The band is allowed to remain under pressure long enough to cool sufficiently so that the reaction of the spring will not distort it when released.

Dies for making coupler rivets are made in the form of a hammer swage with a spring handle set into the ends of the blocks so that the smith can handle it into and out of the machine with facility. A "chair" is bolted to the die-bed of the machine into which the dies are set to receive the pressure. The heated rod is placed in the grooves of the die with sufficient length protruding beyond the end to form the head of the rivet, the dies set into the chair and squeezed together by pressure from lever *B*, and the head of the rivet upset by a stroke of the plunger. Spring- and brake-hanger pins are made in the same manner in similar dies. The 1x¼-in. rectangular key-slots are punched in these parts by the same machine and in the same dies in which they are forged, though in a second operation because of the necessity for reheating. For this purpose a slot ⅛ in. deep is cut across the face of each die, as shown in Fig. 3. The dies with the pin in place set crosswise in the chair and the slot is pierced with a 1x¼-in. punch of high-carbon steel. The chair in which the dies rest is so made that the dies can be placed in either position.

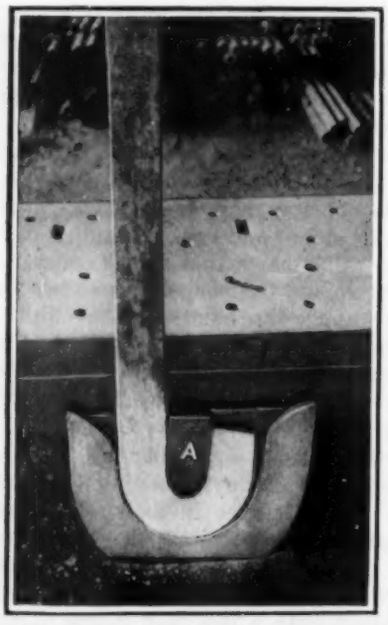


Fig. 4—Die and punch for bending spring hangers

The die shown in Fig. 4 is for making spring hangers. It is not fastened in the machine when in use, but is laid face down on the die-bed and held in place by pressure applied with the upper lever. The heated bar is laid crosswise of the machine in front of the opening in the die, and the small forming punch *A* is placed between it and the shoe on the end of the plunger. As the stroke of the plunger is but 2 in., it requires several movements to complete the bend, but the movements are made very quickly and the bend is completed in one heat. When the former *A* is pushed in as far as one stroke of the plunger will do it, the plunger is drawn back, a block placed between it and the former *A*, and the stroke repeated.

Eye-bolts are bent and loops formed in the handles of fire tools in this machine by the use of a device that bolts to the die-bed. A thick plate is recessed on one side to receive a small gear, the hub of which

Fig. 5—Small pneumatic bulldozer

extends through the plate. Intersecting the recess is a square groove in which slides a short rack that is held in mesh with the gear by the wall of the groove. On the end of the gear hub above the plate is an arm, carrying a stud that is radially adjustable. The hub of the gear extends through the arm far enough to act as a center pin, about which the eyes or loops are turned.

This device is bolted, face down, on the die-bed. The recess is just deep enough to allow the gear to turn freely and the rack to slide. On the back of the plate (the upper side as it lies in the machine) is a hand-operated eccentric lever that pinches the heated rod against the stud end of the gear hub and forms the back bend. A movement of the plunger of the machine pushes the rack along its slot, causes the gear to turn and the arm above the plate to describe nearly a full circle, pushing the rod around in front of the roller and forming a ring, the inner diameter of which is determined by the size of the center stud or of the bushing that is placed upon it. By the use of various sizes of bushings and the adjustable feature of the bending roller, any reasonable size of loop can be turned.

The above sounds like a toolmaker's job—but it isn't. The gear and rack came out of a discarded hand bending machine, and the only machine tool used to make the fixture was a drill press.

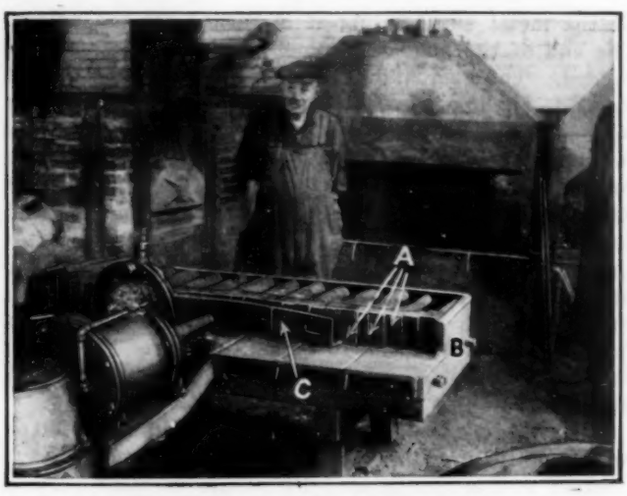


Fig. 6—Spring-bending machine

The flanged ends of grab-handles for freight cars are made upon the machine in dies of the same general principle as those shown in Fig. 3, but with three steps instead of one. The dies have no handles, but are bolted into the machine and a formed punch is attached to the plunger.

The heated rod is placed in the first impression, squeezed by the top lever and the end upset into a rough ball by a movement of the plunger. In the second impression the ball is bent at a right angle to the rod and flattened. It is then placed in the third impression, which forms the flange and punches the bolt hole half-way through.

It is necessary to reheat the forging to perform the third operation, but when several rods are hot the movements follow in rapid sequence, as when the first two are made the rod goes back to the fire and another one on which the first two operations have been done is substituted for it.

The flanges are, of course, formed upon both ends of a straight rod and at this stage are at a right angle to it. The next operation, performed on another machine, makes the bend that brings the base of the flange around into line with the rod and offsets it sufficiently to give the necessary hand clearance when the handle is bolted to a car.

The machine shown in Fig. 5 is very simple and, like the preceding one, was built almost entirely in the blacksmith shop. It is mounted upon a truck so that it may be wheeled about the shop to any place where its services are required, and is connected to the air main by a hose. A forged post of suitable shape to conform to the work in hand, sets in a hole in the base, and the die is attached to the end of the piston rod.

The grab handles above mentioned are formed to shape on it after being flanged upon the larger machine. Sill-steps are also bent upon it, after the ends of the flat bars have been twisted one-quarter turn by the other machine. The piece shown in the machine is a $3\frac{1}{2}$x$\frac{5}{8}$-in. bar, at forging heat, bent to a right angle with a fairly sharp corner.

The device shown in Fig. 6 bends the leaves of elliptic springs to shape. Each of the square blocks *A* has a round shank extending back through a corresponding hole in the heavy forged strap *B* that partly incloses the base, and each shank is surrounded by a stiff coil spring. The faces of the blocks are so shaped that when all of them are pushed back to the limit, the contour of the combined faces conforms approximately to the curve of the completed spring.

The spring leaves are heated in the adjacent furnace. The first move in building up a spring is to drop the heated short leaf (the top leaf in Fig. 2) between the block and the former *C*, and apply the air. Those blocks against which the short leaf rests will recede, but the pressure of the coil springs is sufficient to make the leaf take the shape of the former—which is of much heavier material than the spring leaves and is cold. The short leaf is then placed in the oil tank behind the operator.

The second leaf is then taken from the furnace, placed in the machine and bent in the same way, but before applying the air to the cylinder the short leaf is taken from the oil tank and dropped into its place behind the heated second leaf. As soon as the second leaf is bent, it goes into the oil, but the short leaf remains in the machine.

This sequence is followed until the spring is complete, each leaf being bent, quenched in the oil and returned to the machine so that the next succeeding leaf is bent between the cold former and the oil-quenched leaf before it. The momentary contact of the red-hot leaf against the oil-cooled one has the effect of drawing the temper of the latter, which would otherwise be too hard. The completed springs shown in Fig. 2 are just as they came from this machine and are ready for banding.

Stripping Bands from Springs

Still another application of the air-brake cylinder, is to the machine shown in Fig. 7, the purpose of which is to strip the bands from old or broken springs. The bed of this machine is a couple of I-beams, to one end of which the cylinder is bolted. The object of the yoke *A* is to prevent the leaves from flying about the shop when they have been released from the restraint of the band.

A spring is set into the machine with one end against a stop that is bolted to the I-beams. The fork *B* is made up of two forgings, hinged together near the middle and resting upon rollers *C* that travel along the edges of flat strips of iron laid edgewise upon the bed

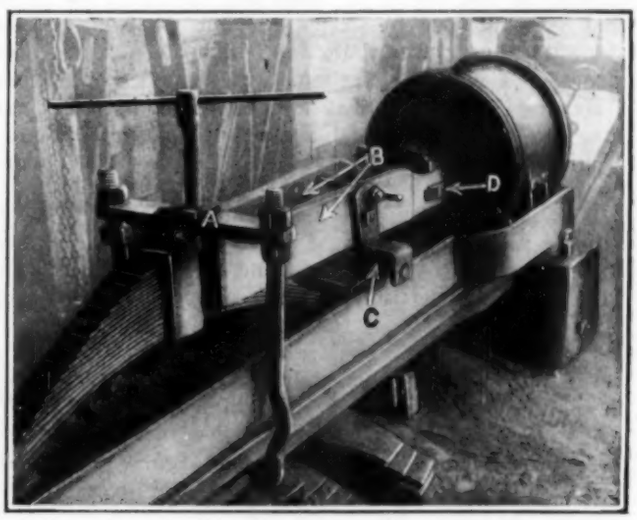


Fig. 7—Spring-band stripping machine

of the machine. It is loosely attached to the piston rod of the air cylinder and each member is provided with a roll *D* that bears upon a cone-shaped piece upon the end of the rod.

When air is admitted to the cylinder the first action is to force the cone between the rollers *D*, spreading the ends of the fork apart and causing the outer ends to pinch the spring tightly. When the sides of the fork can spread no farther the continued movement of the piston rod pushes it forward and forces the band off the spring.

All of these movements take place very suddenly, and, notwithstanding the strict confinement of the spring-leaves in both directions, it is well for the operator not to stand too close to the machine. The location of the air valve at the extreme end of the machine compels him to take up a safe position before applying the air.

Diamonds for Truing Abrasive Wheels

By E. F. Creager

FOR general use, diamonds of one or two carats are large enough. Their size enables them to be securely set and they have just as many cutting points as larger stones. They can be reset many times and are large enough to prevent them from being ground out of the holder.

Some time ago I was in the market for about one hundred carats of diamonds. I patiently listened to and examined the stocks of several salesmen. There was one who did not have the "most perfect lot of stones ever bought at prices that could not be duplicated today," or who said that Grays, or Browns, or Jaegers, were "the best." He said there were good stones in all of them, and that usually the qualities of the different varieties were more a matter of personal opinion than of fact. This sounded good to me. So he picked out fifty stones. Before more than casually looking them over I said "this is the first time I have bought so large a quantity of stones and I expect to be in the market in the future. Future purchases will be based on the satisfaction this lot gives, and an accurate record will be kept of them. Before we look over this lot closely, do you desire to make any changes? I know that you know so much more about what kind of a stone usually gives satisfaction than I do." I left him alone for a while and returned to the office and when I returned I noticed that all the stones of a certain type were missing from the lot. With but few changes I purchased the lot and the stones all gave good satisfaction.

I always buy diamonds unset and send them to some reliable firm for setting. I try to pick out the stones with the most cutting points and fewest visible flaws, to allow for resetting as often as possible, avoiding particularly the stones that show a laminated appearance. Each stone is separately weighed and given a serial number, and separately wrapped. The mounter is required to stamp both the number and the weight of the stone on the mounting. I keep a record of the use of each stone as to how many times it is used, and try to have certain stones used for dressing the wheels, the others for truing only.

Before a diamond is turned in for resetting, nearly all the metal surrounding it is turned off the holder. The end of the holder is cut off, leaving the stone imbedded. The remnant of the mount is then dissolved in acid, freeing the stone for remounting. By this method the stone has not been put to any undue stress in taking it out of the holder. The stone is again weighed and sent in for resetting. The new weight deducted from the original, gives the loss and the cost for the number of times the stone was used. After the stone has been reset many times and all of the points are worn off, there usually is enough of it left to be disposed of at some price or other. Then the first cost, plus the cost of mounting, less the credit for the piece left, divided by the number of times used, gives the cost per dressing.

Almost every shop of any size has its diamond setter, and after trying a number of them out, I found it was cheaper and better to send the stones to some reliable firm for mounting. It has always been a wonder to me that a diamond will stand the "white heats" and "corking" that instructions say are to be used in mounting, and it is remarkable that any service is gotten out of many of them. Hence, be they Jaegers, Premiers, Weseltons, Whites, Grays, or Browns, give them all the chance you can and save money by doing it. Don't save it, as some do, by buying one diamond and locking it up in the safe, whence it is taken by the general manager and delivered by him to the user in person, together with its history, size, cost and the care that must be exercised in its use.

Estimating Costs

By P. E. Chapman

The writer, who is now turning gray, has noted the degree of accuracy usually attained in estimating costs. In his experience it seems to run about as follows:

The estimator who has had limited experience in shop procedure or has seen few of the bills the job shop has to meet, and who thinks his boss wants the work, will be inclined to exaggerate a bit and will estimate anywhere from a twentieth to a tenth of the final actual cost.

If he hedges a bit or just tries to be honest and accurate he might go as high as an eighth of what the finish will show.

Should he, by chance, have a bit of shop knowledge from barking his knuckles on the job in the past, his figure would even come up to a quarter too low.

Had he done his share in the shop before he started to push a figuring pencil, say ten or fifteen short years of job work, he will know just a few of the troubles that happen. Then perhaps, if he has nerve, the figure he makes will be close, just a little short as a rule.

Should this same buddy quit estimating, as a job, and risk a bit of his own good cash on a contract or so his ideas of cost will get quite a jolt.

If he keeps his head up and stays in the game for say ten more years, he begins to realize there may be a word called profit.

If his nerve is still with him he will figure some more and some day, perhaps, his slogan, "We want the job," will change to "We want the profit on the job."

That's where I stand now and I've turned gray getting there, but I'm going strong and my prices are right for both sides, and someone else can be the Christmas tree.

How to Estimate Machine Shop Costs

By Albert A. Dowd

Estimating special machinery—Method of approach based on character of drawings furnished—Sample estimate sheets—Set-up time, assembly, test and their bearing on the final figure

WHEN estimates are to be made on the cost of manufacturing special machinery, a great deal depends upon the data provided. Given an assembly blue print and complete part details, the process resolves itself into an estimate of machining and fitting single parts to make a complete mechanism when assembled. When an estimate is required on the cost of building a machine for a certain purpose, and when there are no drawings provided, the problem presented to the estimator is much more difficult.

Assume that complete assembly and detail drawings of a certain special machine are handed to the estimator with which to prepare a complete estimate on producing it ready for use.

The first step should always be a careful study of the assembly drawing in order to obtain a clear understanding of the purpose of the machine and the manner in which it is expected to function. This involves a continual reference to the details, which should be spread out so they can easily be seen when required. As to the proper methods for this kind of work, there is a difference of opinion. Some estimators take one sheet of details after another, listing the pieces and specifying the time necessary for machining without particular regard to their positions in the completed mechanism. Then, after totaling the time required for each piece, they add a lump sum for assembling and testing. There are many chances for error with a method of this kind and the writer believes that successful estimates on any kind of work can only be produced by the use of a system in which less of the element of chance exists.

The Unit System

Every machine, no matter what its nature, can be separated arbitrarily or otherwise into a number of units, such as headstock, tailstock, carriage, gear box, etc. This is the logical method of assembling, so it is consistent to use a similar system in estimating. By taking one unit at a time, the various problems connected with the machining and assembly are more clearly apparent and can be estimated more accurately. Many sheets of paper are often required for listing the parts so most men prefer the simplest kind of a form. Some of the forms which have been illustrated previously are adaptable.

No matter how the data is recorded, it is seldom that the estimator goes into the detailed processes of estimating for each operation, as this would consume an unnecessary amount of time. A shaft which is to be turned and threaded would be analyzed about as follows: After considering the accuracy required, the estimator would allow perhaps 4 hr. for turning, 1 hr. for threading, and extra time, according to requirements, for grinding or for any other operations needed. He might even lump it all in the estimate and call it 6 hr. for the job. So also in planing or milling operations, he considers the difficulty of setting up, the necessity for finding suitable tools or cutters, possibly the setting of an index head on the milling machine, or some accessories which may be needed and allows for them. He allows generously for time required for set-ups on machines. He also allows for extra tools, cutters,

Headstock

CH.	NAME	DET NO.	DWG NO.
✓	Head Casting	16	A-262
	Straps	17	"
✓	Caps	18	"
	Special Screws	19	A-263
✓	Threaded Collars	20	"
✓	Spindle plug	21	"
✓	Spindle bushing (front)	22	B-96
✓	" " (rear)	23	"
✓	Spindle	27	"
✓	Cone pulley	32	A-262
	Large Gear	34	"
✓	Small Gear	36	"
✓	Back Shaft	37	B-96
	Back " collar	39	"
✓	Clutch body	40	"
✓	Clutch Cone	41	"

Fig. 74—Special machinery unit reference list

or fixtures which may be required and includes the cost of making these items.

The component parts of the machine should be carried through the factory on a manufacturing basis, as far as possible, in order to economize in the machining. The supervision of the work should be in the hands of the department where the assembling is to be done. The limits for manufacturing can be put on the blue prints in red or white pencil according to requirements. This matter is, of course, outside the field of the estimator, but the fact will not help him any in the eyes of his superiors if the estimated time is greatly exceeded. It is wise to have a good idea of the procedure in the shop and the co-operation of the heads of the various departments. A suggestion here

This is the twenty-first article. The twentieth was concluded on page 276, Vol. 62.

and there will often result beneficially to all concerned.

On work having a great number of details, the most efficient method of estimating is to separate the various units into groups which are to be assembled with each other. This is sometimes difficult unless the detailer has followed the same method. Casting drawings, for example, are often made on separate sheets for convenience in the pattern shop. For estimating purposes, it is a good idea to prepare a list like that shown in Fig. 74 for each unit so that none of the parts will be omitted. A printed sheet is unnecessary and a simple

EST NO. 3622-B SPECIAL MACH'Y SHEET NO. 1 OF 12
CUSTOMER Mesurac Mfg Co. DATE 11/4-23

PART NO.	NAME AND OPERATION DATA	LABOR HRS. OR MATL. LBS.	HOUR OR LB. RATE	LABOR COST		MATL. COST.		REMARKS
16	Head Casting							
	Plane and Tongue	8						
	Bore and Ream	4						Dept #3
	Dr and Tap	2						
	Babbitt	2						
	Scrape bears	4						
	Fit Bore	2						
	Bench Work	2	24@2¢	48	00			
	Pattern	12	12@2¢	24	00			
	C I	46#	.08			3	68	
27	Head Spindle							
	Turn. Mill Bore	12						
	Cut Threads	4						
	Harden	.5						
	Grind	4	20.5@2¢	41	00			
	40 Carb Steel	32#	.15			4	80	
	Forging	2	2.50	5	00			
32	Cone Pulley							
	Bore and Ream	2						Dept #3
	Turn Steps	3						
	Crown	1.5						
	Finish Inside	2						
	Mill and Tap	1.5						
	Spec Arbor	3	13@2¢	26	00			
	M. S	12#	.10			1	20	
	Pattern	8	2¢	16	00			
TOTAL SHEET				160	00	9	68	

Fig. 75—Special machinery detail reference sheet

card of convenient size, ruled up to suit, or even without ruling will answer the purpose. Such a list is very convenient to handle. Some estimators check the various parts with red pencil on the assembly or detail sheets but this writer believes a separate list is much better as there is less likelihood for error.

If the estimator prepares his list from the assembly drawing and details, listing the parts first and then setting down their location, he can easily check off each item as the estimate is made. When through, he can be reasonably certain that none have been omitted. This preparatory work takes a little time but it saves a great deal of hunting up details and reduces the process to a well defined, convenient, and logical system. After preparing the cards, the estimator can suit himself as to procedure, picking out first, for example, the head casting and other details pertaining to the head and checking each off as the time estimate is made.

A convenient form for this kind of work is shown in Fig. 75. It is simple and permits of as much or as little detail as the estimator sees fit to use. For example, in Fig. 75, the estimator has given 8 hr. for planing and cutting the tongue on the head casting, item 16. This includes a time allowance for setting it up and all incidental time connected with the operation. Greater detail can be given if desired, but is not usually done, although the estimator often roughly figures the time taken for machining a certain surface at a conservative speed and feed, particularly when large surfaces are involved. Otherwise these are very deceiving.

In some factories, the estimator cannot put prices on either the labor or material. When this is the case the totals should be given in labor-hours and the materials kept separate. The form can be readily modified to suit conditions, for, in any case, the general method would be the same. Some estimators separate the set-up time from the actual machining time, but the only advantage obtained by this method is that the estimator, when checking, can be certain he has included the set-up. Another method is also used occasionally. The set-up allowances are lumped for all settings, but this is not good practice as there are more chances for omissions.

It is a decided advantage to have a well defined system and an established routine to follow. Often, on casting work, the pattern is considered first, then the weight of the casting, and finally the operations required to machine it. On bar or forging work it is good practice to start with the cut-off or forging operation.

The cost of assembling is an important item and, when using the unit system suggested, there is not much chance of forgetting the various operations required. It is not generally considered good practice to include assembling costs on the regular estimate sheet as this is likely to result in confusion.

A form of assembly sheet, useful in making estimates of special machinery, is shown in Fig. 76. Columns are provided for operations, labor-hours, and labor-cost. There is no column for material as this is not needed. To show the application of this form, consider the headstock, item No. 1. The headstock caps are fitted and bearings scraped for the head spindle. The straps are then put on and fitted and small parts of various kinds assembled. After this has been done, the completed headstock is assembled on the bed of the machine and adjusted as may be necessary. With this system, the entire process of assembling can be followed through in a logical way, avoiding nearly all chances of errors or omissions of important fitting operations. In the remarks column, data can be entered regarding any general information of importance. The assembly sheets are numbered in sequence with the other sheets in the estimate. The totals can be given in hours or dollars according to the system used.

Special Tools or Gages

It is seldom possible to make up any special machine without the use of a few special tools or gages, although these may be of the simplest kind. An angular piece may require a cheap fixture to facilitate setting up. A special form may require a formed tool or cutter of such shape that considerable labor is involved. A templet gage may be needed in one or two places and arbors or plugs, which are not of standard size, are frequently found necessary. It is best to include items of this kind on the general estimate sheet, supplemented with rough pencil sketches on a sketch sheet which can be numbered and filed with the estimate. Such sketches should show the idea proposed with sufficient detail to

permit making an estimate of their cost. The sketches are also of help in designing if the contract is secured. Drafting time should be included when anything requiring a pattern in needed, as also the pattern time and the cost of material.

When several special machines are to be built simultaneously, savings can often be effected by carrying all parts of the same kind through at the same time. The set-up time can then be distributed to some extent, lessening the cost of production. This phase of the situation has been previously discussed, except as it applies to the manufacture and use of special tools or gages which may be needed.

Time and expense can be saved by using simple templet and layout jigs when several pieces of the same kind are to be handled. The estimator must be governed and guided by his knowledge of the shop conditions, the accessories available, etc., in making allowances for special tools. In the careful consideration of these various items lies the difference between a good estimate and a poor one. "Foresight is better than hindsight," and estimates made in a painstaking manner with a well defined and logical system, combined with a broad knowledge of shop methods, prove their worth, not only in helping to obtain the contract but also in its fulfillment in a profitable manner. Many factories lose contracts because the estimates are too high. Others lose money on contract work because the estimator did not allow sufficient time for assembling, fitting, special tools and similar items, which were absolutely essential to the work.

Summary Sheets

A summary sheet, similar in form to that shown in Fig. 77, is very convenient to complete each estimate. In the example shown, the summary is sheet 12 of 12 sheets, the total to make up the completed estimate. Columns are provided for the totals of each numbered sheet with labor and material separated. After adding the items, the totals are given and a percentage added to the cost of the material for handling. An allowance is also made for the final testing. After the total amount has been entered the completed estimate is generally turned over to the sales department, for such comments or additions as may be deemed necessary.

In making up estimates on building special machinery from drawings furnished by the customer, a disavowal of responsibility for the functioning of the mechanism is usually made on the quotation in some fashion similar to this: "This estimate considers manufacturing, in a workmanlike manner, the machine shown on the blueprints with units properly fitted, assembled and ready for use. It does not however guarantee the working of the machine as this is dependent on the design."

Much trouble is often caused, in the manufacture of special machinery, by the necessity for changes here and there during construction, and it is sometimes difficult to convince a customer that such changes are not the fault of the factory. It is wise, therefore, to modify the quotation by a note to this effect: "Changes or modifications in construction will be considered as extras and charged at our regular hourly rate for labor, with material at cost plus 10 per cent."

If the machine is to be tested it may be necessary to belt it to a countershaft, or motor, and run it under power, in which case a statement as to the charges should be included in the quotation. If these matters are not distinctly mentioned trouble is certain to result, and every point, having to do with extra work, should be distinctly specified so that there will be no chance for an argument with the customer.

A prospective customer frequently appears with a request for a special or automatic machine for a certain purpose. He has no drawings of this machine but has well defined ideas as to what he wants it to do. After stating his requirements, he first wants to know whether such a machine can be built and then what the cost will be. Sometimes he wants to know the cost before asking whether the machine is feasible or not. This

EST NO 3642-A ASSEMBLY-SPEC. MACHY SHEET NO. 10 OF 12
CUSTOMER Massey Mfg. Co DATE 11/4/23

NO. REQ'D.	NAME OF UNIT AND DATA REGARDING ASSEMBLY OPERATIONS	LABOR HRS	RATE PER HR.	LABOR COST		REMARKS
1	Headstock complete					Dept. 5
	Fitting caps and Bearings	4	2.00	8	-	
	" Straps	2	2.00	4	-	
	Assembling all Parts	6	2.00	12	-	
	Assembling on Bed	3	2.00	6	-	
1	Tailstock complete					Dept. 5
	Fitting Spindle	1	2.00	2	-	
	Adjustments	2	2.00	4	-	
	Assembling all Parts	3	2.00	6	-	
	Assembling on Bed	2	2.00	4	-	
1	Cross Carriage					Dept. 5
	Fitting Dovetails	8	2.00	16	-	
	Fitting Ways	6	"	12	-	
	Assembling Screw & Nuts	4	"	8	-	
	Hand fitting Small Parts	8	"	16	-	
	Assembling on Bed	4	"	8	-	
	Testing alignment	2	"	4	-	
	Adjustments	6	"	12	-	
1	Front Gear Box					Dept. 5
	Assemble Sliding Gear	8	"	16	-	
	" Clutches & adjust	12	"	24	-	
	" All Bearings	4	"	8	-	
	Put on Oil Holes & Oilers	3	"	6	-	
	Adjust to position on Bed	6	"	12	-	
	Drill and Tap Holes	2	"	4	-	
	Assemble on Bed & Test	6	"	12	-	
TOTAL SHEET				204	-	

Fig. 76—Special machinery assembly estimate sheet

is one of the most difficult problems with which the estimator is confronted and the writer gives, herewith, the only method which he has found practical for this kind of work.

Let us take a simple case as an example. A customer wants an automatic machine for producing a certain unit in quantities of 20,000 per hr. The question is whether such a machine can be built, guaranteed to function properly, and to produce the quantity desired, and at what cost.

If, after consultation and discussion of the problem it appears practicable, a statement can be made to this effect and a further conference requested at a specified time. It is of course assumed that the responsibility of the customer is known or that this will be looked up before spending time on the proposition. Assuming that his financial responsibility is found satisfactory, a skilled designer is directed to spend a few hours in roughing out the idea of a proposed machine. Generally speaking not much more than three or four hours should be spent on this preliminary work as it is certain loss unless the customer agrees to bear the burden.

Assuming he returns at the time stated, the matter can be laid before him somewhat as follows: "We can build a machine such as you want to give you the production required. It must first be designed, then built and tested and all the 'bugs' or 'hitches' overcome. We will then install it in your factory and demonstrate it for at least two days under working conditions. We cannot state exactly what the cost will be at present, but we will design and prepare drawings for the shop on our regular hourly basis. The bills for this work will be rendered you weekly for payment on acceptance.

EST. NO. 364-A SUMMARY SHEET SPECIAL MACHINERY SHEET NO. 12 OF 12
CUSTOMER Meserve Mfg. Co DATE 11/4/23

SH. NO.	REMARKS	LABOR COSTS		MATERIAL COSTS		
1	Arbor Needed	160	–	9	68	Dept. 5
2		212	–	16	90	Dept. #7
3		367	50	106	00	
4	2 Spec reamers	88	–	4	75	Dept. 5
5		187	–	22	45	
6	Gages req'd.	96	–	9	60	Dept. 12
7	" "	83	–	18	00	" 12
8	" "	67	–	6	63	
9	" "	118	–	41	20	
10	Assembling	204	–	–	–	Dept 5
11	"	112	–	–	–	" 5
	TOTALS	1694	50	235	18	

TOTAL LABOR COSTS = 1694.50
TOTAL MATERIAL COSTS $ 235 18 +10% = 258.70
FINAL TESTING ALLOWANCE 20 HRS. @ 2.00 = 40.00
TOTAL QUOTATION $ 1993.20
DELIVERY PROMISE 3 months after receipt of formal order and approved blue prints

Fig. 77—Special machinery final summary sheet

We guarantee that the cost of design will not exceed $.....

This figure can be based on other machine designing costs and estimated with a wide margin for safety.

"In regard to the building of the machine, we can quote you a flat price, only after the working drawings have been completed. This price will consider only the building according to our drawings and will include necessary testing ready for operation. The installation, shipping charges and other items will be subject to a separate charge, to be determined later."

It is possible to make a maximum quotation for both designing and building if sufficient time is spent on the estimate. But, in many cases, this time would be a total loss unless it were possible to arrange with the customer for a sufficient sum to cover the cost of laying out the machine to approximate scale. It is not customary to make charges for estimating work of this kind yet, after an experience covering many years of special machine work, the writer must admit that this method seems the only fair one to both customer and factory. It may be stipulated that the cost of the estimate will be deducted from the contract price if the order is placed.

Many contract shops suffer a loss each year by making estimates on special machinery without sufficient preliminary work. After designing and building them, they find that the cost ran far in excess of the estimated price. It is, of course, possible to estimate costs from previous work of a similar kind, but even here the estimator is at a loss. Unless he adds a very large percentage for safety, the price may be found too low. Freehand sketches, even when made with care, take liberties with the proportioning of parts and mechanical movements. They may appear practical in the sketch but are often found unsuited to the work when drawn to scale, so another scheme must be evolved.

Contingencies Should Be Covered Carefully

Assume that a small scale drawing has been made by the machine designer and submitted for an estimate. The process followed would be about the same as that outlined previously, except that the estimator must imagine many of the details and must proceed to list parts of which he has no definite knowledge. He must make all allowances high enough to cover extreme conditions and also give himself considerable latitude in assembling to cover contingencies.

At the time of testing, he must remember that difficulties may be encountered which will make it necessary to tear down a part of the machine, change the form of a component part or add another. There is no use in saying that these things should be considered in the design, for we all know that. The fact remains that no designer is perfect, and it is the exception, rather than the rule, when a special machine can be assembled that will function properly when it is first set up. It is this part of the work that causes the trouble and extra expense to the manufacturer unless it is provided for in the original figures.

There was a case, not very long ago, when a machine of the automatic type was designed at a cost of $3,200. The estimated cost of building was $7,000. Every part of the machine functioned properly—except one. The cost was only a trifle over $5,000 at this point in the manufacture. Yet the final development and the refinements found necessary to obtain proper operation of this one unit took nearly six months and cost over $14,000—in addition to the price quoted. Very luckily for the contract shop, the customer realized the difficulties encountered and submitted, with fairly good grace, to the extra charges. Later, six more duplicate machines were built at a cost of $3,600 each.

In brief, and considered from every point of view, the only perfectly safe way to make an estimate on special and automatic machinery of a new type, involving difficult problems in handling, when no drawings are furnished, is not to do it at all, unless the work can be done on the hourly basis after the drawings have been made. In any other way, complicated problems arise which require an expenditure of money sometimes three or four times the estimated cost. It is an unsatisfactory arrangement in the majority of cases, except when machines are similar to others in their operation, for considerable experimental work is nearly always necessary, on which an estimate is difficult to make, if not impossible.

Pertinent Ideas on the Cutting of Threads

BY H. R. FOWLER

SOME time ago the inspector called my attention to a condition that puzzled him. He had passed some ¼-20 U.S.S. threaded rods as satisfactory according to the thread gage, but when a standard nut was screwed on it was too loose, notwithstanding the fact that the gage was practically as good a fit in the nut as in the female gage. The investigation that followed showed a condition that I believe to be more prevalent than is generally suspected and, at the same time, disclosed a remedy for the trouble.

The rods mentioned were of Monel metal, a material that tends to dull tools rapidly.

Looking at the threads under a glass, one could see that the points of the dies had rounded over slightly. The operator, following his usual practice, adjusted his die until the gage went on nicely. Fig. 1 shows, in an

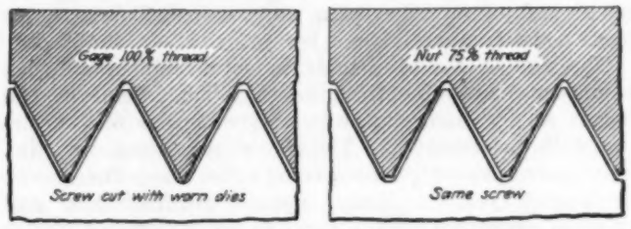


Fig. 1—Gage tight with full thread. Fig. 2—Nut loose with 75 per cent thread

exaggerated way, what he actually had. The thread gage, of course, was made with full thread, the minor diameter coming right up to where it theoretically belonged. Looking at Fig. 2 it can be seen what happened when the 75 per cent thread came along. Is it any wonder the nuts were loose?

In order to let the minor diameter of the screw enter the minor diameter of the gage it was actually necessary to make the pitch diameter smaller, the rounded points of the dies making the minor diameter of the screw, the only point which the gage touched.

On page 573, Vol. 60, I previously mentioned grinding out the minor diameter of female thread gages 15 per cent to correct this trouble and asked the opinion of any who were interested. Several replied favorably and, since then, my experience has boosted my courage up to the point where I have had every female thread gage in the shop opened up in the minor diameter 20 per cent. I say, "boosted my courage." I needed a pretty firm conviction that I was right, considering the fine pieces of work the modern gage maker turns out, mechanical jewels, nothing less.

While a toolmaker was altering the gages, we had a very practical demonstration, convincing to everyone who saw it. A special shaft had been made of chrome-vanadium steel. One end had a 1¾-in.—10 U.S.S. thread, cut in a lathe, with a single-point threading tool. The inspector's gage had been ground out the 20 per cent, while the shaft had been cut to a gage with the full thread. The inspector nearly had a fit when he found his own gage and the nut for the shaft both loose. Same old story; the tough material had rounded the point of the threading tool and made a false fit. The foreman declared there was something wrong with the gages and there was, but not what he thought, for when he ground out his gage, it was just as loose as the other.

The national Screw Thread Commission's report on page 11,* under General Specifications, Rounded Root Forms, says, "The crest clearances allowed are such as to permit rounded root forms in both nut and screw. These may be formed either by tools purposely rounded or rounded as a result of wear in use."

They should have gone one step further, and told us how we can consistently allow that rounded root form in both nut and screw and expect to get a fit with the type of thread gage with which probably 95 per cent of shops are equipped.

Thread comparators are fine instruments in the inspection room and for quantity production, but I can't see how they can ever supplant the common type of working thread gage for the man on the machine. Consider the shaft I just mentioned. It weighed about 400 pounds.

We have about 150 thread gages in the shop, many of them, of course, being duplicates, but as the sizes run all the way from ¼-in. — 20 to 9-in. — 8 U.S.S. it looked as though we had some job ahead.

To facilitate the grinding, we clamped each gage to a large face plate and used a small electric tool post grinder. At first we made up threaded plugs and used them to indicate the setting of the gage. When we realized how many different sizes would have to be made, however, we saw we would have to change that method.

There are several good dial indicators on the market which have a "hole attachment." We used one of these and over the end, which usually goes into the hole, we soldered a piece of brass tubing about ½ in. long. This was long enough to cover three or four threads and the accuracy attained, within a couple of thousandths, was considered close enough as it was principally clearance we wanted.

On page 652, Vol. 61, A. R. Nottingham speaks of full V-threads for steam work. I didn't suppose it was possible to make anything but a tapered pipe thread steam tight. In the few instances where we have to break into a steam space with a straight thread we use a shouldered plug with a corrugated copper gasket and even then occasionally have our troubles holding tight against high pressure steam.

GOOD THREADS OR "DOPE"

We find it much better practice, where studs are used, to avoid drilling through, into the steam space, leaving about a ¼-in. wall at the bottom of the hole. With a good friction tapping device there is no trouble in tapping to the bottom of a hole. The difficulty of maintaining the average pipe dies to the correct Briggs standard is responsible for some awful looking jobs in pipe threads. Of course, the die holder itself is often to blame, along with chips and dirt.

Theoretically, a well cut pipe joint should not require anything more than a little oil to overcome the friction of screwing the fitting on. In actual practice, however, if it were not for the "dope" that is usually plastered on a pipe joint, I doubt if very many would ever hold much pressure. All the dope does is to fill in and help overcome the inaccuracies of the thread.

It is quite possible that I have overlooked some recommendations of the Screw Thread Commission, regard-

*American Machinist, on pages 381, 421, and 457, Vol. 61.

ing thread gages, since the subject covers so much ground. The adoption of the 75 per cent thread, I believe, is becoming general among all up-to-date shops, but I emphatically believe that along with it should go something of the sort in relation to thread gages.

There is no question but that the pitch diameter of both nut and screw is the proper place for contact. The main difficulty is in finding a simple method of gaging which would not necessitate the average shop's scrapping any large investment in standard gages.

As to the male gage, I'm frankly stumped. Of course, taps get rounded over, the same as die chasers, but for the present I don't see any way to help it. One or the other must be kept standard. It might be said that if tools were kept sharp there would be no need of tolerances, but commercial production has definite limitations, beyond which we cannot proceed very far.

I wouldn't attempt to say that the method we have adopted is the best or the only way, but, so far, we have been satisfied. It may be that the gage makers are waiting on a demand for something of the sort. At any rate they will know the demand has started on the next order we put in.

The question has been raised as to why have 80 per cent thread in the gage when there is only 75 per cent in the nut. It seems to me the better part of discretion to have 5 per cent over. This allows for such things as tapping a hole slightly off center, using a badly worn die, or having the bar stock in the screw machine run out a little more than the floating die head will take care of. However, I am open to conviction on that point.

Rational Values of Used Machine Tools

By Harry Ensminger

CAN a fair value be determined for used machine tools on a machine-hour basis?

Can manufacturers and dealers be induced to abide by a predetermined scale of depreciation?

Does the modern American manufacturing plant check the age of a used tool in machine hours?

Can a value be created that will bring a better understanding between seller and buyer?

Can a plan based on the above questions be made economically successfully under existing conditions?

These, and many other questions must be considered by any organization attempting to determine values that are to be fair and just to all parties concerned in a used-tool deal. Most of the best manufacturing companies are coming to have definite organizations in their various activities, why not get together and organize one for machine-tool valuation? New economies will have to be effected, due to the ever-increasing competition, and I believe that tremendous economies will be effected if we have a sound basis for reckoning with our used machine tools. This matter should be of extreme importance, especially to the larger corporations that maintain high production and that must have the best-available new tools at all times.

The machine-hour basis seems to be the best for determining used-tool values. It allows of a broad survey in establishing depreciation. The information could be collected by various methods, the questionnaire method directed at representative producers in the different industrial districts probably being the most effective one. I believe that a fair price can and should be established on the machine-hour basis. The cash or trade-in value to be determined by figuring the depreciation from the current market price of new tools.

This method of valuation must be founded on service —on the idea of supplying the quantity production shops with new tools periodically, taking the used ones in trade, and the supplying of small shops with used tools at a fair price. There is always a market for used tools, especially in the small jobbing or contract shop where quantity production is not required.

This seems to be a good time to consider our used machine-tool troubles, and to make it our immediate business to find out what improvements can be made over existing methods. We must consider the possible reduction in new equipment costs, the labor hours, the daily output, the cut in labor hours, the lowering of operating costs and the resulting improvement in the quality of product, by being able to install new equipment more frequently than heretofore.

The age of machine tools in actual machine hours is not an impossible thing to establish. Some of the larger corporations maintain very complete files covering this information. The facts regarding machine hours have proved themselves of value many times over in recent years. Many special requirements and peculiar plant conditions have to be considered, but a complete survey on these points usually shows a way by which they can be overcome.

Maintaining files with this information has offered many opportunities for effecting economies in new installations. The plans for a file of such information need not be elaborate, a simple file will be found to operate to the advantage of both the seller and buyer.

The existing state of affairs between seller and buyer is too often unsatisfactory and if we can create a better understanding between seller and buyer, we shall have taken a long step forward. To develop this plan may entail some expense in the dealers' organization, but the expense would be justified in assuring a square deal to everyone concerned.

Machines instead of men is the order of the day. Machines do much to decrease that largely unknown yet expensive factor—labor turnover. Machines point the way to greater independence of that most expensive of all modern luxuries—common labor. At the same time they make for increased production, lessened costs and fixed charges. The law of increasing returns means that the best equipped industries will yield a proportionally larger increase for any additional time or thought expended on the productive processes. The increasing returns give the scientific manufacturer his great advantage over his indifferent competitor.

It is well known that a point is reached in all industry, where an additional amount of labor will not yield a proportionally large increase, yet the continued installation of new machines works in the opposite direction. And it is also known that hand in hand with any additional amount of labor, goes the extension of labor-saving machinery.

If we give our best thought to this problem of replacing machines frequently, I do not believe there is any doubt as to the future growth and prosperity of the machine-tool industry.

Ideas from Practical Men

The department, "Ideas from Practical Men" is devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters from all over the world. Deseriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Mixed Percentages

By R. B. Willis

I read lately a quoted description of a remarkable plan of bonus payment. I am inclined to doubt the accuracy of the quotation, but here is what it said: "The plan is based upon 80 per cent of the production that time study has shown to be possible without hindrance of any kind."

It is then stated in effect that 81 per cent of the ideal is 1 per cent more than the basic 80 per cent, and that the group whose efforts have resulted in 81 per cent of the ideal production receive 1 per cent more pay for the period showing the increase, the producers of 85 per cent receive 5 per cent extra, and so on up to an ideal production of 100 per cent. The fortunate group that can meet this condition receiving a bonus of 20 per cent.

I do not say that the plan is not a good one, but 81 per cent is *not* 1 per cent but *is* 1¼ per cent more than the basic. Likewise 100 per cent is an increase of 25 per cent and not just 20 per cent as stated. This reminds me somewhat of an advertisement that I read some years ago in which the advertiser stated that some of the users of his product had been able to save 200 per cent of the manufacturing cost.

Tool Efficiency in a Railroad Shop

By C. P. Falkenstein

The illustration shows our method of handling lathe, planer and similar tools to secure the best results. We picked a central location in the shop where we placed a Gisholt tool grinder, gages and charts for grinding, a case of numbered tool models, and a large cabinet to contain all the tools. These tools are all ground by an experienced man and are placed in the sliding trays in the cabinet. The trays bear numbers corresponding to the numbers on the models in the model case.

Grinding tools in a railroad shop

By this method we eliminate the loss of time ordinarily incurred by waiting for tools and by using incorrectly ground tools. One man grinds all the tools according to standard gages, therefore, all the tools are ground correctly and will produce the results for which they are intended. The only grinding a machine operator does is the touching up of a used tool.

At any time a machine operator can step up to the model case, ascertain the number of the tool he needs, get it from the cabinet and leave his worn or broken tools to be sent to the smithshop for redressing.

We have also placed a case of tool models in the smithshop at the toolsmith's fire making it possible to order all our tools by number from him. When a tool becomes too short for service it is drawn down to make a longer tool of the next smaller size, thereby making the fullest possible use of the stock.

The Utility of Split Chucks

By S. W. Brown

Lathe chucks of the draw-in or split type, commonly called spring collets, may be used in many ways other than their regular application of holding work in the spindle of a lathe.

In Fig. 1 is shown a holder consisting of a tubular member *A*, provided with a shank *B* of suitable size and shape to hold in the toolpost of a lathe. The chuck *C* is fitted to the member *A* in exactly the same way as it is fitted to a lathe spindle, and the hand nut *D* takes the place of the usual draw bar, being threaded to screw on to the rear end of the chuck.

This device was designed by the writer as a boring-tool holder for small work. It will take any one of a given set of chucks, usually ranging in size from $\frac{1}{16}$ to $\frac{1}{2}$ in. in capacity, and the boring tools are made by forging a lip on the end of a piece of drill rod of any size within this range that may be suitable to the work in hand.

The length to which the tool is allowed to project is instantly adjustable and no extra overhang need be tolerated. A further advantage lies in the fact that the tool may be removed for resharpening and replaced without disturbing the position of the holder.

This holder is useful for other jobs as well. It is often used in the vise of a hand milling machine, by gripping the shank with the chuck portion overhanging and vertical, to hold small screws for slotting or

IDEAS FROM PRACTICAL MEN

for milling tenons or other shapes on the ends of drill rod. It is also useful to hold small bushings to be reamed in a lathe, in which case the nut end is placed over the tail center of the lathe and the shank held in the hand.

Another application of the idea may be seen in Fig. 2, which represents a device to hold drill rod, or other round stock, on the faceplate of a lathe to turn small

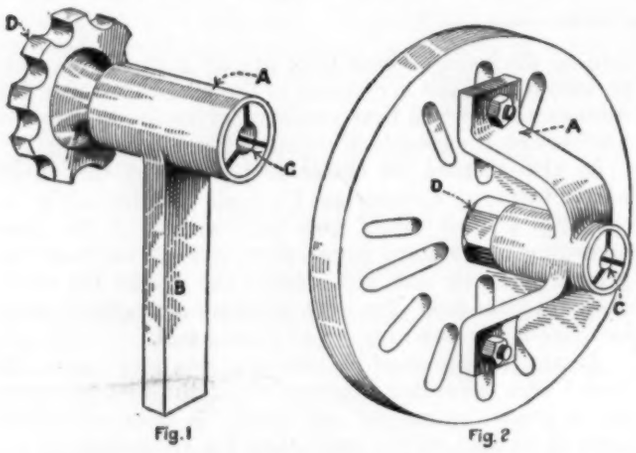


Fig. 1—The split chuck as a boring tool holder. Fig. 2—Applied to the turning of eccentric studs

eccentric studs and similar parts. The casting *A* is bolted to the faceplate and the bow provides sufficient space to render the draw-in nut readily accessible to a wrench. A hexagon nut is substituted for the hand nut for reasons which should be obvious.

A rod held in the chuck may be trued up or set to any desired and definite amount of eccentricity within its diameter by using an indicator in the toolpost, or measuring with a scale from a parallel laid across the shears of the lathe, and tapping the fixture sidewise until the needle of the indicator or the graduations of the scale register the desired amount.

At little expense this fixture could be made in two parts and provided with a micrometer adjustment to facilitate accurate settings.

Eternal Vigilance the Price of Accuracy

BY R. B. WILLIS

A job of helical fluting was set up in the milling machine, and as more than average accuracy was required the piece was "marked round" before starting the actual cut so that any possible variation in the spacing would be discovered before the job was spoiled. The piece was about 8 in. in diameter and was keyed to the mandrel.

The cutting had been carried about three-quarters of the way around when an error became noticeable, at which time the work was stopped and a search instituted to determine the cause. The key was found to be tight, no looseness of parts of the index-head existed, and the dog had not slipped on the mandrel. The trouble was finally located in the following combination, which had been working against the job from the start.

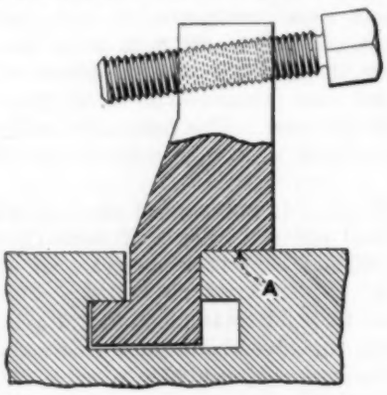
The driving dog was a round-tailed one and the tail was bent slightly sidewise. To make it secure in the driving yoke a shim had been placed under it and the setscrew set up very tightly. The shim was a piece of annealed brass.

As soon as the strain of the cut was applied, the soft metal of the shim commenced to flow, with the result that the grip of the setscrew gradually loosened and allowed the bent tail of the dog, which was slightly distorted when the pressure of the screw was first applied, to work back slowly to its natural bent condition, thus turning the work slightly with relation to the driving yoke.

A Simple Planer Accessory—Discussion

BY K. H. CRUMRINE

In an article under the title given above, published on page 854, Vol. 61, of the *American Machinist*, T. Heaton shows a screw post for use in the T-slot of a planer, which he thinks is superior to the one shown on page 749, Vol. 60, by F. J. Wilhelm.



An improved screw post

While Mr. Heaton's post is undoubtedly an improvement over that shown by Mr. Wilhelm, it has certain deficiencies that are more fully taken care of in the post shown in the accompanying sketch. This post has been in successful use for several years in plants with which I have been connected.

Although Mr. Heaton's post is doubtless less expensive to make than mine, all the strains set up by pressure of the screw are taken by the ledges of the T-slot, which are the weakest part of the machine table. In the post shown in the sketch, the surface *A* has a solid bearing on the top of the table and, while taking up no room on the opposite side of the T-slot, it provides ample length of thread for the screw.

Posts of the style shown can be economically made by planing strips to the proper section and cutting to suitable lengths.

A Trepanning Tool for Wood

BY J. A. LONG

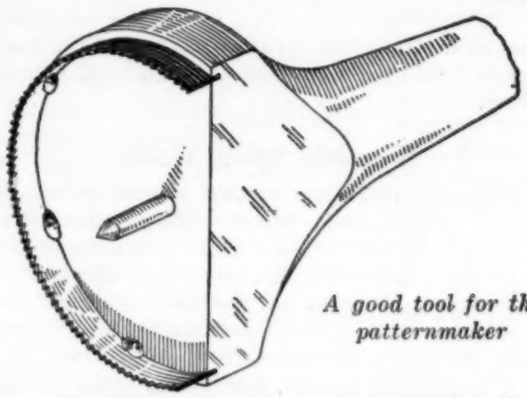
The illustration shows a useful tool for the pattern-maker, especially when boring holes of comparatively large diameter in thin wood. In making plugs to cover screw heads, it is invaluable.

Hack-saw blades can be annealed and curved to fit the groove in the end of the steel holder as shown. After fitting to the holder, the ends of the saw blade

IDEAS FROM PRACTICAL MEN

are soldered together at the joint. Three or four drops of solder spaced around the joint between the blade and the holder will prevent the blade from coming out.

A small pointed center in the holder, projecting slightly beyond the blade and backed by a light coil



A good tool for the patternmaker

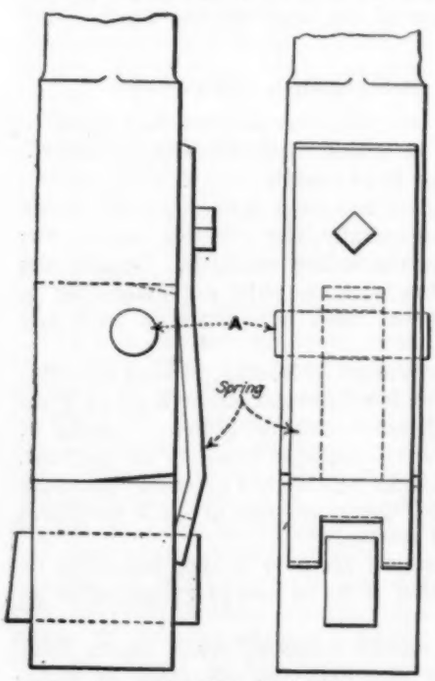
spring, will keep the tool in place when starting the cut. A pattern-maker equipped with a set of tools of this type, varying in size from ¼ to 3 in. can turn out plugs and filling pieces with great rapidity.

An Extension Toolholder

By F. M. A'Hearn

The toolholder shown in the illustration is a valuable addition to the tool equipment of a small slotter. When provided with a round or octagon shank the bar may be easily adjusted to the various positions called for in slotter work.

With an auxiliary arm or holder to fasten into the toolblock of the planer it becomes an adjustable extension tool. This is a useful arrangement, as the extension bar or holder need not project from its support more than the actual distance required. This advantage is not obtainable with a one-piece bar with the end bent to 90 degrees.



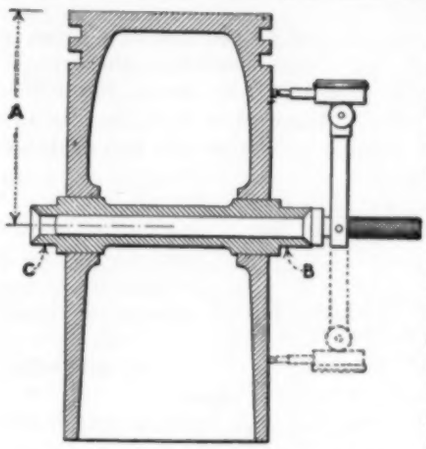
An extension toolholder

The construction is simple. The end piece supporting the cutter is pivoted on the pin *A* and is returned to the cutting position by the flat spring shown. The pin may be tapered or straight. It should be a light drive fit in the outside holes and an easy fit in the hole of the end piece. The end piece should work freely in the jaw, but it should not be loose. It should be so fitted that it will not place the cutting stress on the pin.

Checking Piston-Pin Alignment—Discussion

By W. G. Ogilvie

Referring to the article under the title given above by J. P. Muirhead and published on page 165, Vol. 61 of the *American Machinist*, I question the method described because two separte bushings are used as a guide for the ground bar.



Gage for piston-pin alignment

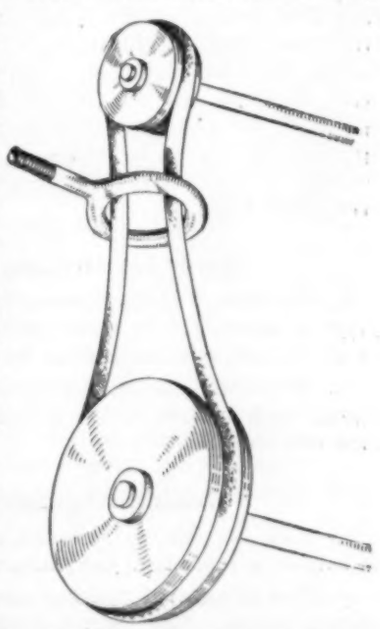
The accompanying illustration shows a method that gives better satisfaction as the two bushings have been replaced by a one-piece guide which goes through both holes. The diameters *B* and *C* are the same and could be used for checking dimension *A*, which is important in a Diesel-engine, as it determines the final compression pressure.

Polishing the Insides of Eyebolts

By C. B. Mackay

The illustration shows a very simple method of polishing the inner edges of eyebolts.

The polishing belt is coated with abrasive and runs over two pulleys, the lower one of which must be larger in diameter than the hole in the eyebolt. The belt is taken off one of the pulleys and threaded through the eyebolt as shown. When the belt is in motion, the eyebolt will be put through all sorts of gyrations by the opposite directions in which the two parts of the belt are moving. By this means, almost one-half of the rounded side of the eyebolt will be polished. The lower pulley is adjustable so that the belt may be given any tension.



Polishing rig for eyebolts

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Pressure Exerted by Punch Presses

Q. Can you give us a formula for determining the pressure exerted by a punch press when the ram is near the bottom of the stroke?

A. Since the energy exerted by the ram of a press is derived from the energy of the flywheel at the expense of its speed, it can be determined by noting the difference in velocity of the flywheel when running idle and just as the work of punching is completed, and applying the following formula:

$$E_1 = \frac{(V_1^2 - V_2^2)W}{2g}$$

in which E_1 = energy in foot pounds given out by a flywheel while the velocity is reduced from V_1 to V_2;
W = weight of flywheel rim in pounds, at mean radius;
V_1 = velocity at mean radius of flywheel rim when running idle, in feet per second;
V_2 = velocity at mean radius of flywheel rim at end of punching, in feet per second;
g = acceleration of gravity, or 32.16.

Analysis of Steels

Q. What is the analysis of a steel that will be best suited for a moving part in an internal-combustion engine? The part will be subjected to violent changes of temperature, the range of which may be anywhere between zero and 1,600 deg. F. The steel must be forgeable.

A. Inasmuch as you know all about the requirements for the steel you wish to use, we suggest that you procure that section of the S.A.E. handbook dealing with iron and steel specifications. The members of the S.A.E. have accomplished a large amount of research work on steels and the results given in the Society's handbook are the best obtainable. The handbook can be obtained either in whole or in sections from the Society of Automotive Engineers, 29 West 39th St., New York City.

Motor for Driving a Planer

Q. We have a 24-in. planer that we wish to convert from countershaft to motor drive. The cutting speed is 40 ft. per minute. What hp. motor shall we use?

A. We would suggest using a 5-hp. motor. If no heavy work is done on the planer, a 3-hp. motor would probably be sufficient.

Making Expanded Metal

Q. Will you tell me how the expanded metal, which is used as a substitute for plastering lath, is made?

A. The process of making so-called expanded metal is very simple. The sheet is perforated by either piercing or slitting in gang dies, and then expanded by gang punches or drifts to the desired extent. All the work is, of course, done in a press large enough to accommodate the sheet.

Noiseless Spiral Gears

Q. Can noiseless, spiral gears be cut on a milling machine? Should they be cut with a gear cutter or with a hob? We have to cut quite a variety of timing gears of the spiral spur-type. As our production is not large enough to warrant the purchase of a gear shaper or a hobber, we have been cutting them in a milling machine with varying success.

A. It is possible to cut small spiral gears of the so-called noiseless type in a milling machine, provided the proper cutter is used and the indexing mechanism of the machine is accurate. The cutter should be made for spiral gears and for the exact number of teeth to be cut. However, we do not recommend the practice as accurate gears should be cut on a machine having a much larger index wheel than is used on a milling machine. When the index wheel is larger than the wheel to be cut, its errors are reduced.

To hob gears on a milling machine would require a special attachment in which there was provision for driving the gear in unison with the hob.

If, as you say, your production does not warrant the purchase of a machine adapted to cutting spiral gears, we should advise you to have the gears cut by someone who is properly equipped for the work.

Lapping and Honing Cylinders

Q. Can you give me any information in regard to methods of lapping cylinders, both cast iron and steel? Does lapping produce good results?

A. Lapping cylinders has been done for many years and was almost universally the practice before the advent of the cylinder-grinding machine. Usually the lap was an old piston with the skirt cut diagonally to give it spring and was used in connection with any suitable abrasive.

The later practice, known as honing, is used in cylinders after they have been ground, as well as in place of grinding. The hones consist of strips or blocks of abrasive mounted in a suitable head so as to float. Springs under the blocks provide the necessary pressure for honing. In use, the hones are given a combined rotary and vertical motion.

The hones vary in grit from 60 to 180, depending on whether the operation is to be one of roughing or of finishing.

Some hones are rigidly mounted, while others float With hones rigidly mounted, the operation is virtually one of reciprocating grinding, since considerable metal is removed.

Floating hones merely polish the surface and do not enlarge the bore appreciably.

Technical Abstracts

Alferium

Alferium, the new light-weight alloy introduced by the Schneider Works, Creusot, France, is said to be an aluminum-copper alloy.

The behavior is very much like that of duralumin, however. The high strength qualities are brought out after quenching, only by an ageing process lasting from four to five days. The heat treatment involves the use of temperatures of 480 to 500 deg. C. Mechanical working should be effected between 375 and 450 deg. C. Cold working is as easy as that of brass.

The strength qualities are: Elastic limit 31,000 to 40,000 lb. per sq.in.; ultimate strength 51,000 to 60,000 lb. per sq.in.; elongation 14 to 22 per cent; modulus of elasticity 10,700,000 lb. per sq.in. The specific gravity is 2.8; the melting point 640 deg. C.

The metal is not attacked by fresh or salt water, but should be varnished. It is attacked by soda and potash, but not much by acids. Under moist conditions alferium is corroded by contact with steel and somewhat less by contact with copper. It should be riveted with alferium rivets.

The metal is delivered in all the common forged and rolled shapes, including tubes.—*Le Gènie Civis*, Dec. 27, p. 608.

Problems in Machining Large Gears

Lewis H. Kenney, engineer of the U. S. Navy Yard, was faced with the problem of making reduction gears in which the large gear had a pitch circular diameter of 146.183 in. meshing with a pinion of 9.903-in. diameter; the width of the gear face was 21 in. The teeth were helical and their normal pitch was 0.058 in. The angle at which the teeth were cut was 30 deg. 27 min., 31 sec.; the weight of the gear wheel was 60,000 lb.; the weight of the pinion was 15,000 lb.; the weight of the gear shaft was 13,000 lb. The gearshaft and wheel rim was class B forgings, Navy Department specifications of mild steel; the tensile strength of the pinions of nickel steel was 95,000 lb.

The machines for cutting these gears was brought over from the Parsons Marine Steam Turbine Co., Ltd., England, and were equipped on the principle of the creeping gear that supplied the means for imparting a small movement of the work relative to the master worm wheel. The accuracy of the work of the machines that were used was checked by cast iron rings and it was found that the time required to make one complete cut around the large wheel was approximately nine 24-hour days. The method of spacing the cuts so as to insure accuracy in this are fully detailed in the article and it is stated that the final gears were cut so that the noise produced was a low hum indicating that the alignment was satisfactory and that the teeth were accurate.—*The Iron Age*, Jan. 22. p. 263.

Tendencies in Building Design

H. K. Ferguson believes that the single-story building — everything else considered—is probably the most satisfactory unit to erect. Abundant light, ventilation, ease of access, elimination of elevators and stairs, and favorable conditions for the use of efficient conveying systems all tend toward this.

The selection of the proper building is something that has to be considered individually because of various conditions. The cost of the one-story building is greater per sq.ft. of available floor area than multi-story structures and these factors must be weighed and considered.

Mr. Ferguson believes that small parts and rather light manufacturing can be carried on more cheaply in multi-story buildings, but for quantity production of large heavy parts, a single-story building has the advantage.

The Ford Motor Co., he states, is changing over to single-story assembly buildings and getting away from the group multi-story buildings they recently erected for assembling.

A factory is more than a floor, roof and four walls, and the making of goods on a large scale is gradually moving toward the fact that the physical plant is usually the most important phase of the establishment. Another interesting thing that Mr. Ferguson brings out is that plants generally are operated more efficiently in the smaller cities than in the very large cities.—*Factory*, January, p. 49.

Employee Qualification Rating Scale

Qualification rating scales for employees have neither attained the high place in personnel practice that they deserve nor accomplished the results predicted for them by their originators. The main reason seems to be that both the psychology of the rater and the needs of the organization have been largely disregarded.

In the first place, the qualities of characteristics to be rated are usually referred to in abstract, bloodless terms that may mean anything or nothing—integrity, loyalty, industry, adaptability, co-operativeness and so on. As the meaning of such words varies with the background and temperament of the rater, long finely printed definitions are needed.

Secondly, qualification rating scales have almost invariably been formulated and put into effect with no definite purpose in view. Most of these scales seem to have been designed more to furnish suitable material for research than to serve as effective instruments in personnel practice.

A rate form is given and this is routed from the personnel office to the foreman or immediate superior and thence through the shop superintendent and general foreman, the form returning to the personnel office by the same route. Two reports are secured on a new employee one when he has been on the job ten days and another twenty days later. This form asks questions regarding ability, attitude and progress. It is stated that this is working out successfully. This article is by W. H. Woodruff, assistant personnel director of the Ingersoll-Rand Co.—*American Management Review*, January, p. 4.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Another Attack on Distribution Wastes

EVIDENCE continues to pile up that as a nation we are emerging from the production era into the distribution era. Now it is the American Association of Advertising Agencies that is to inaugurate a department of research under Dr. Daniel Starch, formerly of the Harvard School of Business Administration. The work to be done is in the field of marketing.

Just what is the primary factor responsible for the suddenly awakened interest in market analysis, distribution wastes and the like, it is hard to say. It is quite probable, however, that it is a reflection of the growing tendency of business men and industrialists to think along engineering lines. In other words, the engineer has pretty well licked the production problem. Now, in his constant search for new worlds to conquer, he is attacking distribution.

The advertising agencies are to be congratulated on their progressive action. To give maximum service to their clients they must have market knowledge. To get it requires effort that can well be dignified by the name of research. Working in co-operation with other organizations interested in the same quest they should add much to efforts to eliminate waste in American business.

Fancied Economy in the Aviation Policy

EVERY business man knows the necessity of having dependable sources of supply for such material and parts as are outside his line of manufacture. He also knows that he can better afford to pay a little more than an absolute minimum price in order to keep these sources of supply from becoming crippled in time of need. In the same way many manufacturers retain a skeleton force and run at a loss in order to assure a working organization when the demand increases.

If these principles of business could be taught in West Point and Annapolis we would have less unfavorable comment on the business conduct of the air services of both the army and navy. We would not have an aircraft industry struggling for existence while millions were being spent in government shops for building and repairing planes.

We all appreciate efforts toward economy. But too often the economy is imaginary rather than real. The saving of a few thousand dollars on plane repairs can hardly be called economy when it makes it impossible for the best builders to keep their plants in operation. For without these plants we are bound to drop lower and lower in the scale of aviation development.

Government plants for experiment and development are needed. But they should not try to develop ALL the devices and refuse to try the ideas of others. In fact it might even be advisable to have the government plants test out commercial devices for the most part.

One great difficulty is that some men seem obsessed with the idea that a uniform endows them with both experience and knowledge like a magic cloak. In reality few of them have had the practical engineering experience of the man in manufacturing lines and to ignore or belittle private development is suicidal to the advancement of any new art.

Financing Foreign Competition

A POINT that should not be overlooked by bankers granting loans to foreign industrial corporations is the nature of the use to which the money will be put. Manufacturers and exporters of German machinery seem particularly obsessed with the belief that export business must be done on a precariously long credit basis. Liquidation of certain German firms in the Far East showed that their methods had been most unbusinesslike, so much so, in fact, as to result in demoralization of the market for their competitors.

The bankers who financed German business of the type mentioned were British financiers and the result of their operations was to facilitate a most deadly kind of competition for their own machinery manufacturers.

If the same practice is to be followed in the use of the high-interest-rate industrial loans asked of American bankers by foreign borrowers, the effect upon the American machinery industry, so far as exports are concerned, will be disastrous. It is not too late to sound a warning to the bankers and it is very much to their own interest to heed such a warning.

Just Suppose

JUST suppose the builders of machine tools got together and resolved that: WHEREAS, we, the makers of the Master Tools of Industry never receive our full reward for inventions, development and service—be it

RESOLVED that we will not sell our machines except on the basis of a percentage of the saving effected over a five-year period in order that we may profit by the benefits as well as the user.

Sounds like an ultimatum—and generally speaking we're "agin 'em."

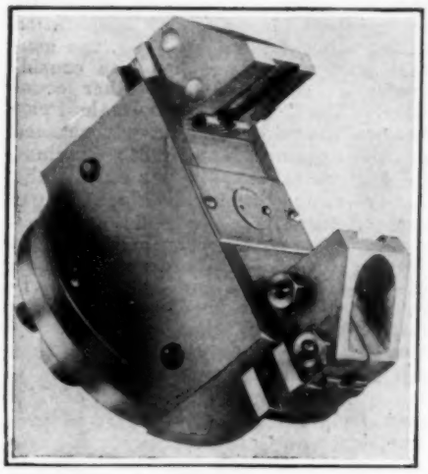
But—

Just suppose.

Shop Equipment News

"Manufacturers" Two-Jaw Steel Air-Operated Chuck

The Manufacturers Equipment Co., 5704 West Fillmore St., Chicago, Ill., has added a line of chucks, that are made entirely of steel, to its other lines of similar equipment. There are four sizes, 6, 8, 10 and 12 in. to hold work that is respectively 2, 4, 5½ and 7 in. in diameter.



"Manufacturers" Two-Jaw Steel Air-Operated Chuck

The steel construction has made it possible to reduce the weight to approximately two-thirds of that necessary in a cast-iron chuck of equal capacity. It is also made shorter than usual practice has called for with cast-iron construction thus reducing the overhang by approximately 15 per cent.

The jaws are adjustable on the slides, a 1-in. movement being provided to allow for special settings to accommodate varying sizes of work. Two bolts lock them firmly on the slides at the desired point. Dovetails are also provided for holding false jaws.

The company estimates that the steel chucks will last approximately three times as long as the iron chucks they are intended to replace.

General Electric Motor Starting Equipment

Three types of motor starting equipment have been added to the existing lines manufactured by the General Electric Co., Schenectady, N. Y.

One type, as illustrated in Fig. 1, is an inclosed magnetic switch for starting two and three-phase alternating current motors. The other two types are similar to each other and are designed for starting synchronous motors.

The one illustrated in Fig. 2 is intended for full-voltage service while the other is for starting with the voltage reduced. They are designated respectively as CR-7006-D9, CR-7065 and CR-7061 in the company's catalogue.

The inclosed magnetic switch, Fig. 1, is for use with motors that can ordinarily be connected directly on the line. A relay operating from the heat generated on starting affords protection against overload. The switch can be push-button operated.

Both of the synchronous motor equipments are full-automatic and are provided with a temperature relay for overload protection, a time relay which controls the accelerating interval in which the motor is connected to the compensator taps, and a field relay for closing the field contactor.

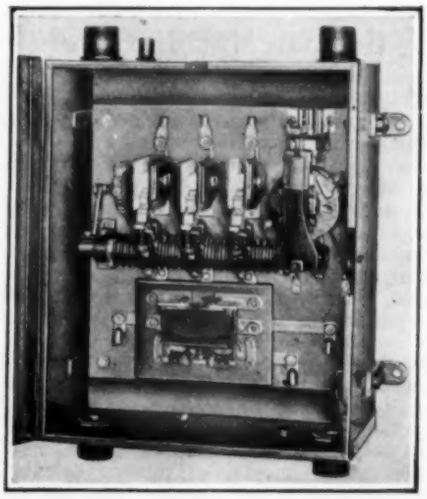


Fig. 1—General Electric Inclosed Magnetic Switch No. CR-7006-D9

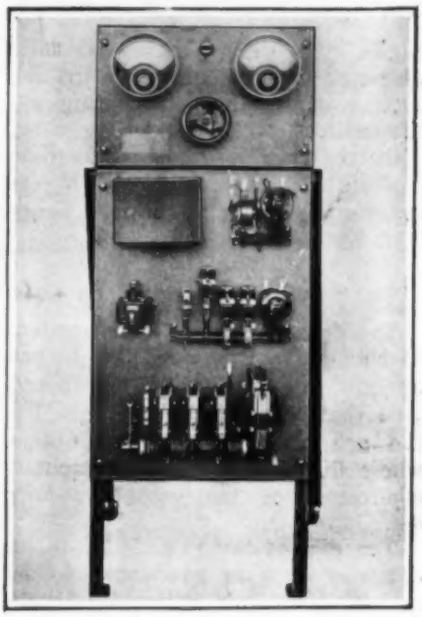


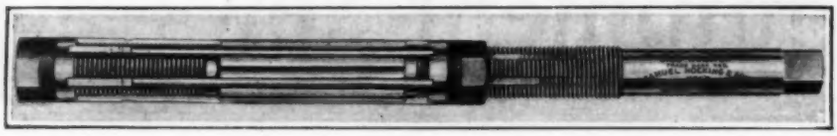
Fig. 2—General Electric Synchronous Motor Starter No. CR-7065

The style illustrated in Fig. 2 is proposed for application to slow speed synchronous motors while the other is for starting those which operate at higher speeds.

Hocking "Mirr-O-Ream" Expansion Line Reamer

The Hocking reamer illustrated has been developed as an improvement, for certain purposes, to the line of expansion reamers made by Samuel Hocking and Son, Lancaster, Pa., and previously described on page 976, Vol. 56 of the *American Machinist*. The tool is particularly adapted for reaming piston wrist-pin holes. Nine sizes are made that cover a diameter range between 0.615 and 1.531 inches. The essential change that has been made to the company's standard line lies in the addition of a pilot to the end of the reamer. This was accomplished by lengthening the shank and the cutters and by grinding this additional cutter surface to guide the cutting

SHOP EQUIPMENT NEWS



Hocking "Mirr-O-Ream" Expansion Line Reamer

edges. The design makes the pilot diameter variable in step with the cutting edges, thus facilitating adjustment.

On the smallest size this increase in length on the cutters which represents the length of the pilot is approximately 1⅛ in., while on the largest size 2 in. has been added.

The features of double relief on the cutting edges, steady rings at the ends of the blades, and special quality of steel for the various parts are the same as originally adopted.

Federal Bench Gage Model 35

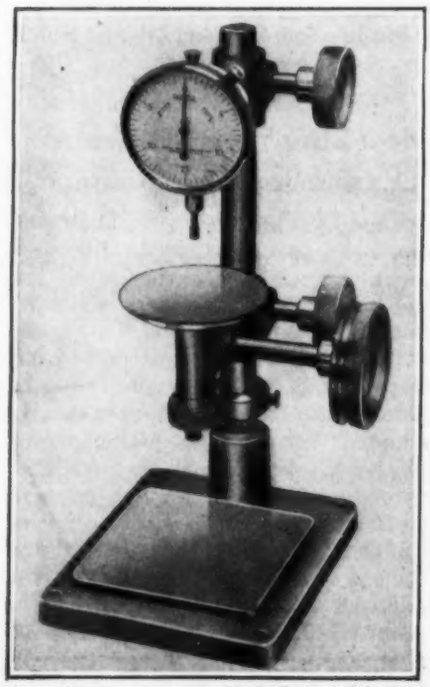
The Federal Products Corporation, 15 Elbow St., Providence, R. I., has brought out a gage of the bench type that is especially designed for the use of inspectors and others whose duties involve the continuous application of the gage for long periods of time.

The dial of the gage is 2¾ in. in diameter and is graduated to 30 major divisions, indicating thousandths of an inch. Between each of the major divisions a short mark enables the operator to read the gage in half-thousandths without difficulty.

Both dial and work table are adjustable upon the column and are clamped in any position by means of the smaller knurled-head binder screws. The work-table has an additional vertical movement within its bracket which is actuated by means of the larger knurled head at the right of the bracket.

In order to leave both hands of the operator free to manipulate the work a groove is cut around the periphery of the knurled head and a cord, laid in this groove, leads to a small pedal below the bench. The operator can thus use both hands to locate the work under the indicator spindle and then raise the table to a stop by pressing the pedal.

The spindle of the indicator is provided with a small button on top so that the table may be locked in position and the gage manipulated by hand in the usual manner. This movement is useful when gaging long pieces, in which case the table is swung out of the way and the work allowed to rest upon the base of the fixture.



Federal Bench Gage Model 35

German Machine Tool Conditions

The slight improvement occurring in the German machine industry in October did not continue in November, although it can be said in general that business was slightly better in domestic and foreign machinery market, according to report to the Department of Commerce by Trade Commissioner Pilger, Berlin. The percentage of firms reporting satisfactory orders increased about 15 per cent in November in comparison with preceding months. A number of plants in eastern Germany are still reporting unsatisfactory business.

It is claimed that the largest obstacle to be faced is the lack of capital and credits. Domestic consumers demand credit and many transactions fail to bring results because of the high interest rates and the impossibility of extending merchandising credits. The same is true of export orders, as the banks are quoting excessive rates for guaranteeing payments. On the other hand, the supplies of raw materials are not offering any relief in the shape of credits or deferred payments, making it all the more difficult to extend credit to ultimate consumers. Price cutting is still the rule and prices continue to show a slight downward tendency. Payments are coming in slightly better than in preceding months and drafts have been put into circulation to a larger extent.

Manufacturers are concerned regarding the rise in the level of prices in Germany and are trying to obtain further reductions in taxation, especially in turnover, income, and corporation taxes. In the last half year, the general gold price level has rise considerably as compared with other countries. The "General Wholesale Price Indices," based on gold, have increasaed as follows since May, 1924: Belgium, 3.5 per cent; France, 5 per cent; Italy, 1 per cent; Czechoslovakia, 1.5 per cent; Sweden, 1.5 per cent; and Germany, 7 per cent. (The price level in Switzerland has fallen 4 per cent since May, 1924.) Coal and iron prices remained stable in November until the last of the month when, with the creation of the Crude Steel Trust, they again showed an upward tendency. It is stated that the average level of German freights is 1½ times that of prewar, whereas German freights for machinery are 2 to 2.5 times as high and for machinery for export 2.3 to 3.3 times as high as in 1913. Railway freights for machinery are considerably lower in France, Belgium, Austria, Czechoslovakia, and Italy.

Textile Fluctuations

The slight improvement in the textile machinery industry has again given way to depression, orders being less in November than in October. The machine tool building industry reports a slight improvement in most plants. Power machinery manufacturers are experiencing a lack of orders while the situation for makers of transportation and hoisting devices has improved slightly in comparison with preceding months.

Many German firms are sending men to the United States to study the American machinery industry and to find ways to improve the output and efficiency of German plants and to reduce general factory expenses and overhead.

Interesting developments have been made in the affiliations and fusions between various manufacturers of machinery. The most recent amalgamation took place between the Motorenfabrik Deutz A. G., Cologne Doutz, and the Maschinenbauanstalt Humboldt, Cologne-lalk. This amalgamation is probably the most important occurring in the German machine industry and provides for a sharing of the profits into two equal parts, each firm maintaining its individuality. The principal reasons for these affiliations are improvements expected in technical and administrative problems.

News of the Week

British Outlook for the Coming Year is Encouraging

Better general conditions will help machine tool trade

At this period of the year it is usual for business men to survey the previous year's working and consider the prospects of business for the coming year, states an editorial by A. E. Mathewson in *British Machine Tool Engineering*, published in London. For the engineering industry, what are its prospects and what improvements are indicated?

For several years industrial development has been retarded through international unrest, general instability and heavy taxation, together with continental competition rendered particularly keen by economic conditions that have obtained. During the coming year, however, we can expect to find all these conditions greatly improved. Better understanding abroad and a stable Government stimulate the confidence so essential to business expansion. It is probable that taxation will be considerably reduced and continental competition far less keen. The cost of production on the continent is undoubtedly rising and there is every indication that this increase will continue. The Dawes scheme, by which it is intended to stabilize German currency, will have this effect, and moreover France cannot continue to evade the economic consequences of her financial burdens. British finance and British industry will inevitably reap the benefit of the heavy sacrifices that have been so uncomplainingly made to establish British credit again on its former incomparable level.

Improved Outlook

The trade prospects for the coming year do undoubtedly show a great improvement and it is logical to expect a very satisfactory balance sheet at the end of the year. To obtain this, however, it will be necessary to take advantage of every opportunity offered. Satisfactory balance sheets do not depend on chance circumstances, but on good management and in the engineering industry modern high production plant is an essential factor. Large and continued contracts are only valuable when they can be executed with due profit, and while it is not uncommon to hear it stated "we cannot afford new machines," the real question should be: "Can we afford to be without them?" Expenditure upon plant is undoubtedly an investment and provided there is sufficient work on hand to occupy the plant during its full working hours, then the working of obsolete machinery represents a distinct loss.

The machinists' application for increased wages has recently been widely discussed. It is suggested by some that any increase that may be granted will be shown in the final cost of the product. This, however, is a question which each section of industry must individually decide, but in view of the competition which still will have to be met, the endeavor will be to reduce the actual production costs. The greatest saving in this direction can be effected by installing machine tools with higher productive capacity than the existing plant. In modern engineering organizations, this fact has been ever increasingly appreciated. Even the slight trade improvement since 1923 has resulted in an increased demand for machine tools. In 1923 there was an increase of about 50 per cent in the value of orders over 1922. In 1924 a similar increase was recorded, and if this is maintained in 1925 it will bring the output practically to normal figures.

Midwest Industries Use More Electricity

Electric energy produced by the subsidiaries of the North American Co., serving large areas of the Middle West with current for power and light, indicate that general business conditions were good during the five weeks ended Jan. 29.

"Every one of the five weeks showed a substantial increase over the corresponding week of the previous year," said F. L. Dame, president of the North American Co., in making the figures public. "As the meters supplied by the North American system number more than 650,000, centering largely around the industrial cities of Cleveland, St. Louis, and Milwaukee, we serve about one-twentieth of the country's electricity consumers."

Corporation Reports

Reports from corporations either directly or indirectly effecting the machine tool trade are briefly as follows:

The National Acme Co. for the eleven months ended Nov. 30, 1924 showed net losses of $629,881 after interest, expenses, etc.

The net earnings of the Ingersoll-Rand Co., was $15 a share for 1924 as against $24 a share in 1923. Prospects for 1925 are much brighter, according to W. R. Grace, vice-president.

The Baldwin Locomotive Works shows gross earnings in 1924 of $26,080,352 as compared with $102,762,075 for 1925. The dividend on the common and preferred stock was not earned during the year, but a reserve was set up in 1923 for this emergency. This company also expects to increase its business in 1925.

The Air Reduction Co. earned $8.56 a share of common stock during last year which compares with $12.44 in 1923.

The New Britain Machine Co. reports net earnings of $258,545 which will be paid toward the deficit that a year ago was reported as $1,068,139.

Missouri Pacific Will Buy Equipment

The Missouri Pacific Railroad has made application to the Interstate Commerce Commission for authority to issue equipment trust certificates to the extent of $11,777,755 to apply on the purchase of the following equipment: 20 Mikado type freight locomotives; 10 Pacific type passenger locomotives; 5 switch engines; 2,000 steel underframe 40-ton box cars; 1,000 steel underframe 40-ton automobile box cars; 750 steel underframe 50-ton drop bottom gondola cars; 250 steel 55-ton self-clearing hopper cars; 40 steel underframe cabooses; 10 mail storage cars, steel under and upper frame; 1 mail coach, steel under and upper frame; 10 baggage cars, steel under and upper frame; 2 dining cars; 9 mail and baggage cars; 6 passenger coaches.

Ford Auto Plant for Yokohama

An assembly plant of the Ford Motor Co. will be erected in Yokohama, Japan, upon the incorporation of the Ford Motor Co. of Japan, Ltd., Edsel B. Ford, president of the company, announced Feb. 25. This will be the first Ford factory built in the Orient.

Such expansion, he declared, is warranted by improving economic conditions abroad. Foreign sales of the company last year, exclusive of the business done by the Ford Motor Co. of Canada, showed an increase of close to 20 per cent over that of the previous year.

Baldwin Will Have Service Stations

The Baldwin Locomotive Works has added a service department to its business. This department will look after the erection of service plants for railroads not equipped to repair their own locomotives and cars. For some time the engineering force of Baldwin's has been at work equipping the Northern Railways of Cuba with roundhouses, repair shops and bridges.

Central European Dealers Complaining Against Pirating Designs

Machines copied when market is created by original tool

By a German Correspondent

The copying of American machine tools and tools in Central Europe has since the beginning of the war been developed to such an extent that practically every current machine and tool that is not patented here can now be supplied by domestic manufacturers.

The quality of the copies has been greatly improved in the last 10 years and although design and precision of the best American manufacturers has not been equaled as yet, the difference in the cost of tools inclusive of freight and duty delivered in the Central European countries prohibits even the most energetic and conscientious importer from building up a mutually satisfactory commercial turnover.

To judge from present American prices, the American costs of production, equal quality, are still 40 to 60 per cent higher than in Germany. Ocean freight and in most cases the Customs Tariff have likewise risen considerably since the war and few customers can be induced to accept dollar payment against B/L.

Unless the price of American machines can be brought down to a more competitive basis, quality for quality, the import is likely to remain unremunerative because the loyal American machine tool agent will as in the past have the honor of carrying out the costly pioneer work while the copyists will take up their manufacture as soon as a large enough market has been created by the importer.

SEES END OF IMPORT PERMIT

At present there are still a number of tools that are subject to the issue of an import permit, but it is likely that the pending tariff negotiations and treaties with the different countries will bring this system of permits to an end. After the tariff on American machines and tools in the various countries has been settled on a reasonable basis, a limited and gradual revival can probably take place.

Generally speaking, the future import possibilities are likely to remain more or less limited to special and more complicated machines for the production of which there is either not sufficient market in Central Europe, or designs that have been covered by Central European patents.

As practically all the leading agents developed before and since the war the policy of copying machines, it is of greatest importance that American manufacturers patent valuable designs.

As to the little States that have replaced the former Austria-Hungarian empire, i.e. Czechoslovakia, Jugoslavia, Austria, Hungary, Poland and the Balkan States, the demand for really high-class tools is limited and aside from some demand in Czechoslovakia and Poland, there is practically no market in which a remunerative turnover on a commercial basis can be built up for the present.

To sum up, there are at present no prospects for building up again the extensive and highly organized import business that was carried on before the war, and even a limited turnover can only be developed on the basis of patient and loyal co-operation between American manufacturers and Central European agents.

Flanders Resigns from Thread Commission

The 1924 revision of the report of the National Screw Thread Commission is in the hands of the public printer. It will be ready for distribution within a month.

The Commission is now working on dimensions for bolt heads and nuts and on specifications for the stud fit. These will be published as supplementary sections to the 1924 report.

The stove bolt situation continues to be unsatisfactory. The Cleveland manufacturers persist in clinging to standards at variance with those set up by the National Screw Thread Commission, that were adopted by the Eastern manufacturers. The attitude of the Cleveland manufacturers is said to be influenced by a small minority who are described as being simply recalcitrant. Economic forces, however, it is stated, are operating to bring them to the Commission's pitches and diameters. They have been adopted by the General Motors Co. and other large users. The demand for the standard bolt is such that Eastern manufacturers are absorbing more and more of this business. Objections raised to the large head will not stand in the way of universal standards as the New England manufacturers are willing to adopt heads that can be made on single blow headers.

Ralph E. Flanders, manager of the Jones & Lamson Machine Co., has been forced to retire from the Commission by the requirements of his business. Luther D. Burlingame of the Brown & Sharpe Manufacturing Co. will succeed him. Mr. Burlingame is very familiar with the work which the Commission has done and accompanied its members on the trip abroad in 1919.

Favors X-Ray Machine for Arsenal

The Boiler Code Committee of the American Society of Mechanical Engineers has requested the American Engineering Council to favor the appropriation now before Congress for the Watertown Arsenal that would provide for a 600,000-volt X-ray apparatus to test heavy materials.

Modern development in X-ray analysis has made it possible to reveal defects in material and in jointed construction hitherto beyond detection by any method short of a test to destruction. It is impracticable for even a large industry to support the laboratory and other apparatus necessary for the testing of heavy work. The limited number of applications to this kind of work in a single establishment would make the overhead per job prohibitive. The availability of powerful apparatus of this kind and of a corps of trained and expert observers and operators at Watertown Arsenal affords to industry an opportunity to have such tests made at a reasonable cost and to contribute to the maintenance of an organization which is of great utility if not a necessity to the Ordnance Department.

The present installation at Watertown has been used in this way by industry to great advantage, and such use will increase as the possibilities of the process and its availability become better known. Its usefulness is, however, restricted by lack of ability to penetrate the heavier materials in use, and it is very desirable for industry, as well as for the work of the Government, that a 600,000-volt apparatus be provided.

A request for an appropriation for such a purpose is now before Congress and the A.S.M.E. Boiler Code Committee, realizing the importance of such facilities to the manufacturers of boilers and other pressure vessels to which its Codes and their interpretations apply, is deeply interested in seeing that the application receive favorable consideration of the Appropriation Committees in both Houses.

January Car Loading Makes Record

Loading of revenue freight for the first five weeks in 1925 totaled 4,450,993 cars, according to reports received from the carriers by the Car Service Division of the American Railway Association.

This was the greatest loading for any corresponding period on record, exceeding by 156,723 or 3.6 per cent the corresponding period last year and by 211,614 cars or 5.0 per cent the corresponding period in 1923.

Loading for the week of Jan. 31, the latest reports available, was 896,055 cars. This was a decrease of 28,199 cars under the preceding week and 33,568 cars under the corresponding period last year but 30,641 cars above the same period in 1923.

January Auto Output

The Department of Commerce announces January production of motor vehicles as 212,908 passenger cars and 28,004 trucks, of which 204,607 passenger cars and 26,464 trucks were made in the United States, and 8,301 passenger cars and 1,540 trucks were produced in Canada. Production is segregated for the United States and Canada for each month of 1924, and the combined total for the production of both United States and Canada is given from July, 1921, to December, 1923, segregated figures for this period being not yet available.

Personals

J. B. DOAN, president of the American Tool Works Co., Cincinnati, returned Feb. 28, from a four-weeks' trip to the West Indies.

O. B. ILES, president of the International Tool & Machine Co., Indianapolis, has been selected to head a committee in charge of a campaign to raise $200,000 toward the Indiana state endownment fund of $5,000,000 for the American Legion.

FREDERICK E. MOSKOVICS has been elected president of the Stutz Motor Car Co. of America, Inc.

HERBERT THEURLICH has been appointed the Milwaukee representative for the Marshall & Huschart Machinery Co., Chicago.

PERRY W. RICE has been transferred from the Torrington, Conn., office of the Hendey Machine Co., to the Chicago office.

J. W. FREY is in charge of the newly opened Detroit office of the Landis Machine Co., Waynesboro, Pa. The office is located at 5028 Second Boulevard.

ALFRED L. LOVEJOY has resigned as New York sales manager of the Pratt & Whitney Co., Hartford, Conn. The resignation was upon the advice of his physician.

GEORGE L. MOOREHEAD, office manager of the Link Belt Co., Indianapolis, was elected president of the Foundrymen's Association of Indianapolis at the annual election recently. Other officers are: T. J. Cornwell, vice-president, J. H. Hooker, treasurer, and A. J. Allen, re-elected secretary.

LYNN W. NONES has been appointed Eastern sales manager for the Diamond Power Specialty Corporation, in charge of the Atlantic Coast offices from Boston to Charlotte inclusive. His office is at 90 West St., New York.

A. K. CHAMBERS, formerly manager of the Chicago branch of the American Bosch Magneto Corporation, Springfield, Mass., has been promoted to personal field representative of the general sales manager of the company with headquarters in Springfield.

PAUL M. ATKINS delivered a lecture before the students and guests of L'Ecole d'Education Technique, Paris, on Feb. 7. His subject was, "The Influence of Machinery on the Cost of Production."

BYRON F. EVERITT has been elected vice-president of the Trippensee Closed Body Corp., Detroit. He also was placed on the board of directors.

WILLIAM H. BASSETT, metallurgist of the American Brass Co., has been awarded the James Douglass medal for distinguished scientific achievement in the brass industry. The presentation will be made by the American Institute of Mining and Metallurgical Engineers.

O. M. DAVIS is one of a company that has taken over the control of the Standard Machinery Co., Owasso, Mich.

RALPH R. WEDDELL is now chief engineer for the O. K. Tool Co., Shelton, Conn.

BENJ. H. RHYNEARSON has organized a new company to be known as the Master Door Operator, Inc., with headquarters in Indianapolis, Ind.

E. F. DUBRUL, general manager of the National Machine Tool Builders' Association, is in California for a brief visit.

W. F. SCULLY, formerly president of the Advance Furnace & Engineering Co., Springfield, Mass., has joined the organization of the Gilbert & Barker Manufacturing Co., Springfield. He will be manager of the furnace and factory sales.

WILLIAM P. MCCARTHY will have charge of the newly opened Syracuse office of the Electric Arc Cutting & Welding Co., Newark, N. J.

WILLIAM R. VAN NORTWICK, formerly with the Roto Co., Hartford, Conn., as district sales manager in the New York City territory, has resigned and will open an office at 50 Church St., New York, for the sale of products used in the combustion field.

JOHN J. LAVELLE has been elected secretary of the Lavelle Foundry Co., Anderson, Ind., to fill the vacancy created by the resignation of John Price, which became effective recently. Mr. Lavelle resides in Indianapolis, but has an office in Anderson.

MATT J. HEROLD has returned to the organization of the United States Electrical Tool Co., Cincinnati, Ohio. He will be the general sales manager.

H. S. HUNCKE will have charge of the newly opened Chicago warehouse of the Yost Manufacturing Co., Meadville, Pa. The office and warehouse will be located at 25 S. Jackson St.

WILLIAM T. LIVERMORE nas joined the engineering organization of the International Motor Co., Allentown, Pa., where he will be an engineer on bus design and development.

E. O. SMITHFIELD is in charge of the newly opened Southern office of the International Steel & Iron Co., Evansville, Ind. His headquarters will be at the Bona Allen Building, Atlanta, Ga.

H. D. DE WEESE has been elected vice-president and a director of the Checker Cab Manufacturing Co. He will manage the plant at Kalamazoo, Mich.

O. H. SMITH has succeeded A. K. CHAMBERS as manager of the Chicago branch of the American Bosch Magneto Corporation, Springfield, Mass.

RAY L. BURNSIDE, formerly with L. O. Koven & Bro., Jersey City, N. J., will be the New York representative for the Williams Tool Corporation, Erie, Pa. His headquarters will be at 1431 Broadway.

CHARLES A. SWAN has become associated with the Timken Roller Bearing Co., Canton, Ohio, as assistant manager of steel sales.

Business Items

The Foote Bros. Gear & Machine Co., Chicago, Ill., will be represented in the New Orleans, La., territory by Gibbons & Gordon, 532-534 Canal St., New Orleans, La.

Hayes & Coit, the Leader Building, Cleveland, Ohio, will represent the Lancaster Steel Products Corporation in the state of Ohio and in the city of Buffalo.

The Horne Co., Osaka, Japan, is representing the Stow Manufacturing Co., Binghamton, N. Y., in the Orient.

The Gibb Welding Machines Co., Bay City, Mich., has appointed the Welding Service & Sales Co., Donovan Building, Detroit, as its representative in the Detroit district.

The A. C. Spark Plug Co. has purchased the Dort factory on the Pere Marquette Railroad in Flint, Mich. The plant will be used for the manufacture of air cleaners and gas pumps.

The Clapp, Riley & Hall Equipment Co., dealer in machinery equipment, has bought the four-story building located at 12-24 N. Clinton St., at a reported cost of $200,000. The company's present location is at 12 S. Canal St.

The De Laval Steam Turbine Co., Trenton, N. J., announces that since Jan. 15, 1925, all products of that company, as also the products of the De Laval Separator Co., Poughkeepsie, N. Y., have been handled exclusively in New England by the Turbine Equipment Co. of New England, Chamber of Commerce Building, 80 Federal Street, Boston, Mass.

Distribution of the Acme line of automatic loaders, manufactured by the Acme Foundry & Machinery Co., Coffeyville, Kan., has been taken over recently for the Southeastern territory by W. A. Neal & Son, Inc., 137 Marietta St., Atlanta, distributors of road building machinery in the Southeast.

The E. L. Essley Machinery Co., Chicago, has been appointed exclusive selling agent for the High Speed Hammer Co., Rochester, N. Y., in the Chicago territory.

Obituaries

HENRY CHASE FREEMAN died recently at his home in the Vernon Court Hotel, Newton, Mass., following an attack of heart disease. Mr. Freeman was president and general manager of the H. C. Freeman Co., 141 Milk St., Boston, Mass., distributor of elevating and conveying machinery.

JOHN B. BIRD died recently at his home in Wilmington, Del. He was connected with the Bancroft Co., Wilmington, and was a member of the A.S.M.E.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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A COMPOSITE picture of American business at present would be misleading. The country has grown so big and its activities are so varied that each one must be considered on its own merits. The money market is about the only influence to which they are all susceptible and even a rise in interest rates does not affect business as it did when there were no Federal Reserve Banks.

Therefore the fact that the Federal Reserve Bank of New York has advanced its rediscount rate to 3½ per cent may or may not have the importance that is ascribed to it in some quarters. The advance had been predicted for some weeks and it has recently been foreshadowed by a rise in the rates for both call and time money.

The action of the New York Bank was nevertheless a mild surprise to the Stock Exchange speculators and by some of them it is regarded as a cautionary signal. Early in the week the security market had been quite soft, but a recovery that was in progress when the advance in the Federal Reserve rate was announced was not seriously halted by the news.

It is, however, plain that the speculative enthusiasm has been chilled and that the public are no longer disposed to buy indiscriminately. The demand for bonds is also more circumspect. Opinions differ as to whether the advance in the rediscount rate is justified. The position of the New York Bank considered by itself would appear to warrant the higher figure, but the condition of the Federal Reserve System taken as a whole does not appear to foreshadow any monetary stringency.

The reserve ratio stands at 75.8 per cent as compared with 77 per cent a week ago and earning assets are increased by only $83,000,000, nearly all of which sum is due to a gain in the accommodation extended by the New York Bank.

Turning from the financial markets to those in which merchandise is bought and sold the view is reassuring without being exciting. Distributors who deal with the ultimate consumers say that people are buying what they need, but that they are more critical of the prices asked than formerly.

In woolen goods there seems to be something like a buyers' strike, incited perhaps by the weakness in raw wool and the outgivings of a prominent clothing manufacturer who makes after dinner speeches in which he insists that wool is too high.

On the other hand cotton goods are stronger, reflecting an improvement in the market for raw cotton and a better demand from consumers and manufacturers of cotton garments. Raw silk is somewhat lower, but increased sales of silken fabrics and furs are perhaps significant of the nation's prosperity, although they disturb the manufacturers of cotton and wool.

The price level of the metal group shows but little change. Iron and steel in particular are in fair, but not eager, demand and the industry is working at about 85 per cent of capacity. The demand for cement is said to be active, but lumber is not moving so freely. The amount of new building that will commence with the opening of spring is hard to ascertain, but the work now in progress is rather disappointing to those who had prophesied a building boom this winter.

It is the old story. The prices as well as the pleasures of anticipation are greater than those of realization.

That the converse of this proverb is also true is shown by an advance in the price of sugar. It is up about 20 points because the anticipation of a large crop carried prices so low that buyers have been attracted from all over the world. At this time last year refined sugar was selling at 9 cents. It can now be bought at 6 cents. The higher price was not regarded as unreasonable or exorbitant. It is quite possible that it may be reached again before the present crop is marketed.

The news from Europe indicates continued recovery there. The only cloud is the gradual depreciation of the French franc. Efforts to sustain or advance its value in the foreign exchange market are made and will no doubt continue to be made from time to time. It is, however, apparent that the French people are lacking in the will to pay the taxes that are essential to the maintenance of their national credit and in these circumstances it is to be feared the national obligations will be cancelled by what is euphemistically called "the evaporation of currency values."

Perhaps that will be the easiest way to dispose of some irritating questions. At all events it is a condition and not a theory by which the French government is confronted and until it is disposed of there will be fewer foreign loans brought out here.

What's Doing in Industry

February proved to be a fair month for the machinery and machine tool industry, but by no means an extraordinary one. It was generally considered to be better than January of this year and about on a par with February of last year. However, unlike February, 1924, prospects based upon inquiries this year presage a steady increase in business, whereas twelve months ago but very little business was in sight.

Manufacturers, who were undecided as to the future in January, have shown a more optimistic attitude in February, and in most of the production centers plans are being made for a limited increase in business during the next sixty days. Further than that it is difficult to predict, but authorities are reasonably sure of a better business during the late spring and early summer months than was experienced a year ago.

Railroad buying, which started rather briskly last week, continued and lists that have been issued in both the East and the West would indicate a renewed demand from this source. The Lackawanna in the East and the Illinois Central in the West have sent out promising inquiries and will probably close on them during the coming month.

Automobile production schedules are of a slightly increased order with activity seen among the factories outside of the Detroit area as well as a slight betterment in production figures within the automotive center.

Big electric companies, with the General Electric Co. in the lead, were in the market during the week with small orders. Users of small machine tools were also buyers in all sections of the country.

Supply Association Is Reorganized

At the regular winter meeting of the South Atlantic Supply Association, held in February at Jacksonville, Fla., a partial reorganization was affected, and William E. Dunn, Jr., engaged as an active executive secretary. Henceforth, therefore, the association will operate on a much more active basis in the South, having headquarters in the Healey Building, Atlanta, with the Southern Metal Trades Association, of which Mr. Dunn has been executive secretary for several years.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New York

Machinery and machine tool business during the month of February in the New York district is reported as steady by most dealers and an improvement over that of January. Like January, the first two weeks of the month were the best with some betterment being noticeable during the last few days. While business is far from that done in previous times and there is a total absence of anything closely resembling a "boom" dealers are inclined to be fairly content with the indications for a more even business than has been done in several years.

The Lackawanna and the C. & O. railroads were in the market during the past week with both orders and inquiries, the first named road with a good sized list. Freight car builders were also in the market as were radio set builders for presses, automobile accessory makers for an assortment of tools and the electric companies, notably the General Electric Co., for small orders.

Interest was aroused in the Eastern districts by the evident progress that is to be made by the Locomobile Co. at Bridgeport. This concern has placed a big motor order in Detroit and it is expected that machine tool orders will be forthcoming within the next month. Several firms have been figuring on sales to the Locomobile Co. for more than a year.

Used machine tools found a fairly active market with textile mills buying sparingly and with small factories ordering single tools of a variety.

Chicago

With the exception of farm implement manufacturers, who have increased their operating schedules and are taking more steel, the machinery industry of the Chicago district shows practically no change from that last reported.

Inquiries and orders from railroads, and from large industrial concerns having occasion to employ rolling stock, are reported to be good, including almost every type of freight and heavy traffic cars, in addition to specially built locomotives. Among the industrial companies who either have ordered or made inquiries for cars are Swift & Co., Chicago; the Craig Oil Co., Toledo, Ohio; the Waite, Phillips Co., Tulsa, Okla.; the Republic Iron & Steel Co.; the Canadian Salt Co., Ltd., Windsor, Ontario; the Huron Portland Cement Co., and the Schloss-Sheffield Steel & Iron Co. While these orders or inquiries, totaling nearly 500 cars, do not directly effect the machine tool industry, indirectly they have a bearing upon the business as considerable new and special machinery will probably be required before they can be executed.

Announcement is made that the Kalamazoo Paper Co., Kalamazoo, Mich., is to enlarge its manufacturing facilities and to that end is arranging a fund of $1,000,000 to be employed in providing additional buildings, equipment and machinery.

Southern District

There has been a very satisfactory increase in machine tool and equipment sales among Southeastern dealers since the middle of February, with gross sales now running even slightly better than at this time last year, though business early in 1924 was unusually good. Practically all of the larger dealers seem agreed that the outlook for the next few months is the best it has been in the South in the past four or five years.

This was further evidenced at the mid-February meeting of the South Atlantic Supply Association, at Jacksonville, Fla., membership of which includes many of the larger machine tool distributors in the South Atlantic states, all of whom took a very optimistic attitude over the spring and summer outlook this year. Regarded as a whole, however, the members reported that business during 1924 was somewhat off, in spite of the excellent volume enjoyed during the first half of the year.

As heretofore, the heaviest sales at present are to the railroad companies and to the state highway departments, the latter business particularly satisfactory in all of the Southern states that have been spending hundreds of thousands of dollars in new and rebuilt road construction machinery. Inquiries from both these sources are very active, portending heavy sales well into the spring months at least.

Within the past ten days shop building projects amounting to more than $3,000,000 have been announced by two railroads, the Chesapeake & Ohio planning a $2,000,000 program at Russell, Ky., and the Southern Pacific a $1,000,000 project at Dallas, Tex. These are in addition to several other important projects of the same nature that have been announced the past two months, most of them already under way.

As the year advances textile mill sales also are picking up steadily, and this business at present is probably as heavy as it has been in almost a year, with the outlook bright for continued good buying through the spring and summer because of the unusual amount of new mill construction in progress in the South or contemplated during the next few months. Some of the individual projects already announced to be carried out this year in the South by big mill companies are in excess of two or three million dollars.

There is also continued good buying reported by the smaller machine shops and automotive service stations.

Detroit

Gradual improvement in the machinery and machine-tool industry in Detroit has been noted during the past two weeks and the general upward trend in all lines of manufacturing augurs well for the future.

Production in Detroit automobile factories is steadily approaching normal levels. Despite the fact that the January output was 29 per cent below that of January a year ago, motor car leaders are well satisfied with the present situation. January production was 226,000 cars and trucks, an advance of eight per cent over December. February figures are likely to show the same relative increase.

While no definite announcement has been made recently, it is understood that automotive engineers in some of the leading plants are seriously considering changing equipment to handle all-steel bodies instead of bodies built partly of wood. The amount of new machinery and equipment necessary to such a change on the part of even a few manufacturers who have the factor of safety at heart will have a very inspiring effect upon the machine tool industry.

During the past week the Ford Motor Co. has resumed operations on a full six-day schedule. For some time the Highland Park and River Rouge plants, as well as minor units of the company, have been operating on a five-day schedule. Increased sales and demands for Ford products is given as the reason for the resumption of full-time schedule. The Locomobile Co. of America has ordered 2,800 eight-cylinder motors from the Continental Motors Corp., to cover second quarter engine requirements for the Locomobile Junior Eight. This is one of the largest orders received here in some time.

Employment figures continue to show a gradual increase each week. Railroads report greater carloadings during the past two weeks.

Milwaukee

Some complaint is heard that business in metalworking equipment is not increasing, but this comes from those manufacturers and dealers who have been working their enthusiasm to a pitch not consistent with the plain, unvarnished facts from which the average member of the industry deduced some time ago that it will be a long, hard

pull. Business is better. Of that there is no question, but it is not so active that unreasonably favorable comparisons may be drawn with this period and the corresponding time in the past two years.

Machine tool production schedules have benefited from the improvement in business, but makers are still running at only part capacity. Business is of a decidedly spotty character, orders being rather spasmodic and usually calling for one or two items. Inquiry is better, and what is perhaps more important, the sources are more numerous as to prospective buyers and the character of their business.

The automobile trade purchases in January and February probably run even if not somewhat better than a year ago, but the number of buyers has been smaller. Relatively heavy purchases by a few large concerns have brought up the volume. This business was practically the only evidence of expansion, the remainder being strongly indicative of purely replacement business, with no attempt to gain a substantial increase in capacity.

Renewed buying activity among manufacturers of farm equipment still lies in the foreground. Predictions have been made that this industry was about to become a more important factor in the tool trade, but these seem merely predicated upon the expectancy of a revival in the demand for agricultural machinery as the outgrowth of the enhanced value of farm products. It is true, however, that implement concerns are getting back into steady production.

Manufacturers of contractors' equipment are exceptionally busy, which is a condition that has existed for a year or two and therefore has not excited special comment in the industry. Road builders have been making heavy purchases for three or four months, and this equipment is now in production for early delivery. Gas-powered excavating, hoisting and similar machinery for industrial and commercial construction is also in relatively active demand.

The immediate future holds no promise of a spurt, but there is reason to expect a steady betterment in conditions, which, as a matter of fact, is uniformly considered preferable.

Indianapolis

It may be that conditions during the first three weeks of February were not as productive of business in the tool and machinery industry as had been expected, but the local trade is confident March will show a volume of business sufficient to bring the total for the first quarter of the new year above that of the same period last year. Tool business has been especially spotty during the last two weeks.

Very little demand is coming from the automobile industry. This would indicate that business done during the two mid-winter shows was not entirely satisfactory. Changes in executives during the last few weeks in Indianapolis motor circles has caused a period of cautiousness that is being felt by the tool trade.

Tool demand with the accessory manufacturers is fairly good and the same is true of Indiana body manufacturers. Demand for tools in Indiana steel plants is increasing, as also is the demand for machinery. In several of the larger industrial cities of the state the outlook is especially good in the steel business.

Tool demand in Indiana railroad shops is none too good, but a number of inquiries are being received from rail sources that indicate an early increase in this demand.

New England

Industry in Hartford shows a gradual and steady trend to a better condition. All industries are feeling the improvement.

The demand for skilled workmen is somewhat better, in fact skilled mechanics engaged in the highly technical phases of manufacturing are in demand. What is true in the Hartford section of New England is also true in the Bridgeport district. The improvement in the automobile trade is the reason for the demand for skilled workmen in Bridgeport.

Machinery builders in Hartford, New Britain and New Haven report consistent improvement in business. This is shown in the volume of orders booked and by the inquiries received.

The preponderance of buying in the last ten days among builders of heavy machinery is indicative of an improvement in the automobile trade. One of the manufacturers of bearings reports its production has attained a total of 75,000 bearings daily. This is within a few thousand of the record production previously attained. Another maker of bearings reports a good business volume and both agree that prospective business is such that indications are that new records for output are about to be established.

Builders of special machinery also report trade improvement and the figuring of more contracts than ordinarily.

Small machine builders are fairly busy.

Cleveland

Renewed buying of a wider variety of machine tools and general manufacturing equipment has come into the Cleveland market in the last two weeks. This move backs up the assertions of manufacturers and shop operators that they would be replenishing their equipment as soon as outlet for their own products showed itself. In general, the last fortnight has seen more actual business closed with machinery interests here than has been done, in most instances, for the first six weeks of the new year.

One of the outstanding features of the new development is the absence of new buying interest on the part of the automotive and affiliated industries, and a quickening of demand from general manufacturing. Not many new concerns figure in the ordering done recently, but a number of old clients have responded, indicating that they are enlarging their plants to some extent, and also replacing.

Best business at the moment appears to be in automatic equipment. A wider variety of industries is taking new machines, according to producers here, and an equally wide variety of types also is needed.

In the planer field demand has shown still better progress. Some plants have been putting on some night shifts in order to speed delivery of certain types of this equipment. Here as in other divisions orders have been held back so long that when they are actually placed immediate delivery is one of the essentials specified. Much of this class of equipment is finding its way to Central West industrial plants, though lately a few orders have been booked for far Western points, indicating a revival in industrial activity in sections hitherto considered slow.

More inquiry is noted for heavy duty equipment, particularly shears, punches and similar tools, although this is not yet up to seasonal expectations. Boiler shops likewise are indicating an early need, but in none of these instances has enough business been booked as yet to warrant manufacturers here showing much jubilation.

Philadelphia

Optimism continues to prevail among business men and the heads of industrial establishments throughout Philadelphia. In the machine tool industry, the anticipated return of quantity buying has not yet materialized to the full expectations of most producers, but the hope of the future lies in a satisfactory basic situation which is in evidence on all sides.

Many of the business leaders are looking to the Middle West for early active buying. In fact purchases from that section of the country already have begun, it is shown by a canvass among manufacturers of various sorts. After having been out of the market for four or five years, equipment users from as far West as Oklahoma and Kansas City have communicated with Philadelphia producers regarding new equipment. The same is true in Minnesota and Wisconsin.

In accord with this situation, the general price movement of commodities continues upward. Retail merchants join with manufacturers in predicting a speeding up of business in the spring.

Cincinnati

Machine tool builders in the Cincinnati district, with some exceptions, found February a relatively quiet month. The exceptions were busy, one shop at least running at capacity. Those companies represented by the Marshall & Huschart Machinery Co., Chicago, were engaged in preparing exhibits for the show being held this week in Chicago by that firm.

Foreign orders have been a live issue recently. One large company reports that its business would be almost negligible without them. Others have found little comfort from this direction. Central European agents have been in the city during the past week for the purpose of renewing connections.

Some apprehension is felt over the invasion of the domestic market by German-built "Chinese copies" of American tools that are offered at a fraction of the price of the corresponding American tool.

March is expected to be a good month if only a reasonable proportion of the many inquiries out can be closed.

Veterans Honored by Pratt & Whitney

Eighty-four veterans of the Pratt & Whitney Co., Hartford, Conn., were presented with service buttons at a banquet recently given them by the company in one of the engineering rooms of the factory. The dinner was presided over by Clayton R. Burt, general manager of the company, and was attended by the eighty-four men who have been with the company for more than twenty-five years, the heads of the departments of the Pratt & Whitney Co., and many of the officers of the company.

Two of the men had been with the company for fifty-seven years each, and another had fifty-one years to his credit. Mr. Burt made the presentation of the buttons which were of blue background with the words, "Quarter of a Century Service," in gold letters.

Besides Mr. Burt, James K. Cullen, president of the Pratt & Whitney Co. and the Niles-Bement-Pond Co., Edward L. Leeds, general sales manager of the two companies, William Kopf, sales manager for the Detroit district, William Kirk, sales manager of the New York district, Charles M. Pond, manager of the small tool department, J. Carlton Ward, Jr., factory manager, William H. Miller, sales manager for the Hartford district, W. L. Layland, superintendent of the machine shop, and L. N. Richards, superintendent of the small tool works, were present and spoke.

General Electric Gets Japanese Order

Orders for two 35,000 kw., 11,000 volt, 50 cycle turbine generators and two 1,000 kw., 3,300 volt, 50 cycle house turbines have been placed with the International General Electric Co. by the Hayakawa Electric Power Co. of Kawasaki, Japan. The equipment represents the largest complete units ever sold by any company for export. The Hayakawa Co. will use the apparatus in parallel with its hydro-electric station in the Hamamatsu district for furnishing power to Tokyo.

The order, involving $2,000,000 in construction costs, was received by the Tokyo office of the International General Electric Co. through Mitsui & Co. The Hayakawa Co. is a subsidiary of the Toho Electric Power Co., that holds a controlling interest in the Daido Electric Power Co., one of the largest and most important power amalgamations in Japan.

Motor Bus Business Shows Increase

Demand for motor trucks and buses so far this year has been larger than anticipated. In many quarters orders have been larger than in January, 1924, or than in December, 1924.

This is the conclusion drawn by Edward F. Loomis, secretary of the Motor Truck Committee, National Automobile Chamber of Commerce, as the result of a three weeks' visit to truck manufacturing plants in the middle west. Among the cities visited by Mr. Loomis were: Cincinnati, Indianapolis, Marion, Ind., Wabash, Ind., Chicago, Milwaukee, Cadillac, Mich., Alma, Mich., Pontiac, Mich., Lansing, Mich., Detroit, Lima, Cleveland and Buffalo.

"Manufacturers are both expecting and planning for a volume of business considerably in excess of that obtained in 1924," says Mr. Loomis. "The feeling is prevalent that the use of commercial vehicles will greatly be expanded because of favorable business conditions everywhere predicted for 1925, and because of the increase in hard-surfaced highways.

"Considerable additional capital is being placed in motor bus manufacturing facilities. It is to be expected that about 16,000 motor buses will be built in 1925 as compared with 12,000 in 1924."

Diamond Service Emblems for Employees

Diamond service emblems have been presented by the American Engineering Co., Philadelphia, to 32 of its employees who have been with the company for 25 years or more. Gold medals were presented to 275 other employees with records of 5 to 25 years service. Among those receiving the diamond medals were two machinists with records of 46 and 45 years active service. Both are still employed daily in the shops of the company.

Catalogs Wanted

The Russian Reconstruction Farms, 70 Fifth Ave., New York City, desires catalogs from manufacturers of all kinds of machinery and machine tools.

Calendar of Local Meetings

American Society of Mechanical Engineers

New Orleans, March 5. Sectional Meeting. "The Engineering Profession—Its Antiquity and Its Obligations," Dr. William F. Durand, president of the A. S. M. E. Prof. I. O. Wall, secretary, Tulane University, New Orleans, La.

Schenectady, March 6. Sectional Meeting. Edison Hall. "The Steam Turbine," Oscar Junggren. G. B. Warren, secretary, the General Electric Co., Schenectady, N. Y.

New York, March 11. Engineering Societies Building. Joint meeting of the A. S. M. E., A. S. C. E., A. I. E. E., and the New York Electric Society. "The Engineer as an Executive." F. J. Bechert, secretary, 350 Madison Ave., New York City.

Toronto, March 11. Sectional Meeting. "Elevators," E. M. Benten. H. L. Crane, secretary, 50 Simpson Ave., Toronto, Can.

Chicago, March 11. Western Society of Engineers' headquarters. Machine tool meeting with afternoon and evening sessions. F. B. Orr, secretary, Illinois Maintenance Co., 1,136 Edison Building, Chicago, Ill.

Waterbury, March 13. Sectional Meeting. Chamber of Commerce Hall. "The Engineering Profession—Its Antiquity and Its Obligations," Dr. William F. Durand, president of the A. S. M. E. J. R. Putnam, secretary, Waterbury Clock Co., Waterbury, Conn.

Salt Lake City, March 14. "Machine Tools." W. H. Trask, Jr., secretary, University Club, Salt Lake City, Utah.

Charlotte, March 16 and 17. Joint meeting of Greenville, Raleigh and Charlotte branches. F. S. Davant, secretary, the Grinnell Co., Inc., North Charlotte, N. C.

Birmingham, March 17. Sectional Meeting. "Manufacture and Use of Malleable Iron," George L. Morehead. G. L. Bentley, secretary, the Ingersoll-Rand Co., 1802 American Trust Building, Birmingham, Ala.

Hartford, March 17. Sectional Meeting. Hartford Engineers' Club. "Industrial Mobilization," Major Hobart Somers. C. W. Mayott, secretary, the Hartford Electric Light Co., 266 Pearl St., Hartford, Conn.

Milwaukee, March 18. Sectional Meeting. Milwaukee Athletic Club. Meeting devoted to co-operation with State University on education and training of the industries. Robert Cramer, secretary, 1105 Vliet St., Milwaukee, Wis.

Toledo, March 19. Sectional Meeting. Doehler Die Casting plant. "Visit to the Plant," J. A. Schultz. H. L. Allen, secretary, the Toledo Scale Co., Toledo, Ohio.

New York, March 19. Sectional Meeting. "Development and Use of the Locomotive Stoker," E. W. Englebright and A. B. Fahnestock. T. J. Bechert, secretary, 350 Madison Ave., New York City.

National Association of Cost Accountants

New York, March 10. "The Relation of Cost Accounting to Foremen Training and Labor Problems."

Worcester, Mass., March 12. "The Use of Ratios in Cost Accounting."

Chicago, March 12. "Cost Finding for Different Types of Business."

Philadelphia, March 13. "Credit and Factors in Extending the Same—Character, Capacity, Cash and Collateral." J. H. Tregoe, secretary of the National Association of Credit Men.

Cleveland, March 18. "Financing as a Burden."

Rochester, March 18. "The Future of Motion Study in Industry," V. M. Palmer, the Eastman Kodak Co. "Methods Used in Tying up Factory Accounting with General Accounting," C. J. VanNeil, the Eastman Kodak Co.

Buffalo, March 19. "The Cost of Government," and "The Manufacturing Budget."

Forthcoming Meetings

National Metal Trades Association. Twenty-seventh annual convention. Hotel Cleveland, Cleveland, Ohio, April 22. J. E. Nyhan, national secretary, Peoples Gas Building, Chicago, Ill.

The National Supply and Machinery Distributors' Association. Twentieth annual convention, Ambassador Hotel, Atlantic City, April 27, 28 and 29. George A. Fernley, secretary and treasurer, 505 Arch St., Philadelphia, Pa.

Southern Supply & Machinery Dealers' Association and the American Supply & Machinery Manufacturers Association. Joint Convention. The Atlanta-Biltmore Hotel, Atlanta, Ga., May 5, 6 and 7. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

The Society of Industrial Engineers. National Convention. Hotel Winton, Cleveland, Ohio, May 6, 7 and 8. Executive secretary, George C. Dent, 608 S. Dearborn St., Chicago, Ill.

American Gear Manufacturers' Association. Ninth annual convention, May 6, 7, 8 and 9. The William Penn Hotel, Pittsburgh, Pa. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Spring Meeting. Milwaukee, Wis. May 18, 19, 20 and 21. Calvin W. Rice, secretary, 29 West 39th St., New York City.

Society of Automotive Engineers. Summer Meeting. Greenbrier Hotel, White Sulphur Springs, W. Va., June 16, 17, 18 and 19 C. F. Clarkson, secretary, 29 West 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

National Foreign Trade Council. Annual Convention. Seattle, Wash., June 24, 25 and 26. O. K. Davis, secretary, India House, Hanover Square, New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Iron prices are holding firm despite a drop of $1 per ton in scrap. Demand is fairly active in steel tank and ship plates. There is also considerable buying of bars and shapes. Pittsburgh mill prices range from $2 to $2.20 per 100 lb. on steel shapes and plates; bars are firmest of the hot rolled products, at $2.20 per 100 lb.

Non-Ferrous Metals—Lead and zinc are both ½c. per lb. higher than on Feb. 20. Antimony is rapidly developing firmness. Most of the other non-ferrous metals are a trifle slower, particularly tin. Copper prices are at the Feb. 20 level.

Oils—Machine and engine lubricants are considerably firmer with advances reported in some grades. Raw linseed oil is down about 3c. per gal. in the Central West, compared with Feb. 20 quotations.

(All prices as of Feb. 27)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$26.05
Northern Basic	23.77
Southern Ohio No. 2	23.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	32.25
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.76
Virginia No. 2	30.17
Basic	24.76
Grey Forge	23.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	28.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	23.77
Basic	23.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.70@2.80	3.89	3.45	3.80
No. 12	2.80@2.90	3.94	3.50	3.85
No. 14	2.90@3.00	3.99	3.55	3.95
No. 16	3.10@3.20	4.09	3.65	4.15
Black				
Nos. 17 and 21	3.35@3.55	4.55	4.15	4.30
Nos. 22 and 24	3.40@3.60	4.60	4.20	4.35
Nos. 25 and 26	3.45@3.65	4.65	4.25	4.40
No. 28	3.50@3.70	4.75	4.35	4.50
Galvanized				
Nos. 10 and 11	3.75@3.85	4.75	....	4.50
Nos. 12 and 14	3.85@3.95	4.85	....	4.60
Nos. 16	4.00@4.10	5.00	....	....
Nos. 17 and 21	4.15@4.25	5.15	....	4.90
Nos. 22 and 24	4.30@4.40	5.30	3.00	5.05
No. 26	4.45@4.55	5.45	4.15	5.20
No. 28	4.75@4.85	5.75	5.45	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	59½%	48%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	56½%	45%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches — External	Diameters Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.85	8.00	7.20
Hoop steel	4.49	4.35	4.15
Cold rolled strip steel	7.00	8.25	7.85
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.42½	3.10
Bar iron (3.00@3.10 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb. Chicago, 3/32, 8.85c.; 5/32, 7¾c.; ⅛, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.12½
Tin, 5-ton lots, New York			57.50
Lead (up to carlots), St. Louis	8.85	New York	9.75
Zinc (up to carlots), St. Louis	7.50	New York	8.37½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	19.00	21.00	....
Copper sheets, base	23.00	23.25	22.12½
Copper wire, base	20.62½	21.87½	20.75
Copper bars, base	22.25	23.75	22.62½
Copper tubing, base	25.25	25.87½	25.75
Brass sheets, base	19.62½	20.25	19.25
Brass tubing, base	24.25	26.00	25.00
Brass rods, base	17.62½	19.37½	18.37½
Brass wire, base	20.12½	21.25	20.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	27.20	28.00	27.00
Zinc sheets (casks)	11.50	11.75	11.37
Solder (½ and ½), (case lots)	42.00	37.50	.....
Babbitt metal (83% tin)	60.00	67.50	50.00
Babbitt metal (35% tin)	28.00	21.50	28.00
Nickel (ingots) f.o.b. refinery	29.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	33.00	.....	.....
Nickel (F shot) f.o.b. refinery	30.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.50@12.75	12.50	12.00
Copper, heavy, and wire	12.25@12.50	12.25	11.50@11.75
Copper, light, and bottoms	10.75@11.00	10.25	10.50
Heavy lead	7.50@7.75	7.50	8.00
Tea lead	6.50@6.75	5.50	6.75
Brass, heavy, yellow	7.75@8.00	7.75	8.00@8.25
Brass, heavy, red	9.75@10.00	10.00	9.75
Brass, light	6.75@7.00	6.75	6.75
No. 1 yellow rod turnings	8.00@8.25	8.00	8.00
Zinc	4.50@4.75	4.00	5.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$22.85	$21.00
"A" Grade:				
IC,	20x28, 112 sheets	19.00	18.80	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	13.50	13.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.80@6.90	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.14@0.16
Cotton waste, colored, per lb.	.10@.15½	.18	.09½@.12¾
Wiping cloths, 13¼x13¼, per lb	9.50	36.00 per M	.11
Wiping cloths, 13¼x20½, per lb.	....	50.00 per M	.11
Sal soda, per 100 lb. keg	2.25	2.25	2.25
Roll sulphur, per 100 lb. keg	3.60	3.25	3.75
Linseed oil, per gal., 5 bbl. lots	1.24	1.32	1.25
Lard cutting oil, 25% lard, per gal.	.60	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.33	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	40–2½%
Heavy grade	30–5%	30%	38–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	60%
Second grade	50–10–5%	60–5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0354
Cold finished shafting	per lb.	.0415	.0415	.044
Brass rods	per lb	.17621/2	.17621/2	.155
Solder (½ and ½)	per lb.	.42	.42	.3675
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	60	.60	.58
Machine oil	per gal.	.33	.29	.29
Belting, leather, medium	off list	40–2½%	40–2½%	40–2½%
Machine bolts up to 1x30 in.	off list	45%	45%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	.....
Emery paper	10.71	11.00	$11.90
Emery cloth	28.00	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.65
Cloth	3.38	2.67	3.55
Fire clay, per 100 lb. bag	....	.65	.75
Coke, prompt furnace, Connellsville	per net ton		3.25@3.75
Coke, prompt foundry, Connellsville	per net ton		4.75@5.00
White lead, dry or in oil	100 lb. kegs	New York, 16.25	
Red lead, dry	100 lb. kegs	New York, 16.25	
Red lead, in oil	100 lb. kegs	New York, 17.75	

SHOP SUPPLIES

	New York	Cleveland	Chicago
Rivets: Button heads, ⅜-in., ⅞-in., 1x2-in. to 5-in., per 100 lb.	$3.75	$3.50	$3.50
Cone heads, ditto	3.85	3.60	3.70
Washers, cast iron: ½-in. per 100 lb.	6.50*	4.00	3.75
⅝-in., per 100 lb.	5.50*	4.00	3.75

Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland. Tap bolts with hex. heads are $4.65 per 100 lb. at Chicago.

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 45%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 35%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 40%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 35%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 45%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35%.

Bolt ends, 1x12-in., 10c. per lb., less 45%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ⅜-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 60%. Same discount for tinned. EXTRA per 100 lb. for 1¼ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Mass., Boston—A. E. Orno, 161 Devonshire St. — machinery and tools for large repair and service garage on Ipswich St.

Mass., Boston—Pratt Coal Co., 27 Overland St.—shear or cutter with stand for cutting $\frac{7}{16}$ iron plates.

Mass., Brighton (Boston P. O.) — Scott Bros. Inc., 1-3 Emery Rd.—equipment for machine repair shop addition.

Mass., Brookline (Boston P. O.)—Gilbert & Levine, 78 Brainerd St.—equipment and miscellaneous tools for garage at Vancouver St. and Huntington Ave., Boston.

Mass., East Boston (Boston P. O.)—J. A. Page, 128-132 Coleridge St.—garage repair tools and equipment.

Mass., Medford—E. Teel & Co. (wagon and truck bodies)—blacksmith's forge with full equipment of tools.

Mass., New Bedford—F. J. Greene, c/o L. L. LaBrode, 502 Olympia Bldg. Archt.—equipment for 2 story garage.

Mass., South Boston (Boston P. O.)—Keystone Mfg. Co., 288 A St.—shaper and die slotting machine, Coclin-Bly filing machine.

Mass., Waltham Station (Boston P. O.)—Box 15, Kendall Green. — buzz planer, circular saw, and band saw.

Mass., West Roxbury (Boston P. O.)—James Palladino, 1401 Center St. — miscellaneous tools and equipment for garage and repair shop.

Mich., Detroit—Hudson Motor Co., 12,601 East Jefferson Ave.—conveyors and equipment for assembling automobiles, including 5 ton crane.

Mich., Detroit—Whitehead & Kales Co.—60 ton locomotive crane, with double hoisting drums.

Mich., Fenton—Fenton Tool & Die Co.—die making equipment for new plant.

Mich., Kalamazoo—Knapper Sheet Metal & Mfg. Wks., 216 East Walnut St.—power rotary circle 24 in. throat shear to cut metal up to 8 gage.

Mo., St. Louis — Brook Bros., Mfg. Co. 4434 Hunt Ave.—power press, 50 or 60 tons, (used).

Mo., St. Louis — St. Louis Southwestern R.R. Co., Buder Bldg., E. O. Griffin, Pur. Agt.—2 in. bolt cutter, 1½ in. bolt cutter, combination grinder, 14 in. double emery wheel, electric rivet heater for ¾ in. rivets, No. 5 Universal milling machine, 36 in. sander, 37 in. sensitizing drill press, 6 in. hand bench joiner.

N. Y., Buffalo—Gibbs Properties Inc., 70 Oak St.—small tools and machinery for proposed metal products plant.

N. Y., Buffalo — Polson Mfg. Co., 1750 Main St.—rivet spinning machine.

N. Y., Buffalo — W. T. Randell, 414 Niagara St.—equipment for welding shop.

N. Y., Buffalo—A. Valyear, 145 Ontario St.—small tools and equipment for auto repair shop.

N. Y., New York — Braunworth Co., 60 Broadway — vertical head, heavy duty lathe, for No. 2 Cincinnati milling machine.

N. Y., New York—F. H. Crawford, 299 Broadway—42 in Bullard vertical lathe.

N. Y., New York—Delaware, Lackawanna & Western R.R. Co., 90 West St.—C. C. Hubbell, Pur. Agt.—two 24 in. turret lathes, 20 in. turret lathe, 16 in. x 6 ft. portable belt lathe, journal turning lathe with equipment for 3 cylinder locomotive work, 16 in. x 6 ft. heavy duty bolt lathe, 5 ft. heavy duty radial drill, 6 ft. right line radial drill, 2 sensitive drill presses, up to ¾ in. 50 ton Lucas power press, 84 in. standard vertical boring mill, 54 in. horizontal boring mill, 36 in. Morton heavy duty draw cut shaper, 32 in. shaper, 54 x 54 in x 12 ft. standard metal planer, 5 in. ajax forging machine, 10 ft. power brake or bending machine, high speed pipe cutting and threading machine, blacksmith hammer, Blacker, type B.

N. Y., New York—A. Fallior, 304 West 152nd St.—Heald cylinder grinder.

N. Y., New York—Omin Co., 364 West 120th St., machinery manufacturers—rotary tablet machine, mixer, 2 coating machines.

N. Y., Rochester — North East Electric Co. A. M. Anderson, Pur. Agt.—Hammond high speed radial drill (used).

N. Y., Rochester — North East Electric Co., A. M. Anderson, Pur. Agt.—one, 8 ft. bending brake for $\frac{7}{16}$ in. stock.

N. Y., Salamanca — Salamanca Foundry & Machine Works, 125 Rochester St.—band sprue saw (new or used).

O., Jackson—Milton Iron Co., 5 ton and 10 ton electric cranes.

Pa., East Pittsburgh — Westinghouse Electric & Mfg. Co.—punches and shears, boring mill and hand shears, for Sharon plant.

Pa., Philadelphia—Pennsylvania R.R. Co., Broad St. S. Porcher, Gen. Pur. Agt.—bolt threading machine for Altoona shop.

Pa., Phoenixville — Metal Casting Co., C. S. Wilmot, Wks. Mgr.—foundry and machine shop, equipment, furnaces, conveyor system and electric power equipment.

Pa., Pittsburgh — Carnegie Steel Co., Carnegie Bldg., C. Miller, Pur. Agt.—3 lathes, boring mill and shaper, for Duquesne works.

Pa., Pittsburgh — Richardson & Co. Inc. Oliver Bldg. (manufacturers of rails)—locomotive crane.

Tex., Dallas — J. L. Davis, 1713 North Akard St.—bench lathe.

W. Va., Logan—Guyan Machine Shops—slitting shear for ½ in. plate.

Wis., Janesville — Janesville Sand & Gravel Co., J. R. Jenson, Pur. Agt.—loading crane, for branch distributing yard, at St. Francis, Wis.

Wis., Lone Rock — Greenheck Bros. — squaring shears to shear 16 gage, or lighter.

Wis., Milwaukee — Milwaukee Grey Iron Foundry Co., 39th Ave. and Mitchell St.—foundry equipment.

Wis., Milwaukee — Strobel & Bloedow, 1436 Green Bay Ave.—sheet metal working machinery.

Wis., South Milwaukee — Bucyrus Co., Phillip Knoll, Pur. Agt. — machine tools including, millers, lathes, presses, etc., will purchase the latter part of March.

Wis., Wausau—Carl Manthey & Sons, 435 South Washington St. — power saws for stone cutting purposes.

Wis., Wausau—Curtis & Yale Co., Clinton ton St. & South First Ave.—woodworking machinery for interior finish sash and door factory.

N. S., Sydney — British Empire Steel Corporation, A. McLurg, V. Pres.—machinery and equipment for foundry, including 2 electric cranes.

Ont., Listowel—J. G. Cochrane, Exeter—equipment for general machine and repair shop on Elma St., here.

Ont., Listowel—Fletcher & Nelson, Wallace St. — complete equipment for garage and auto repair shop, service station.

Ont., Teeswater—Teeswater Foundry Co., J. H. Brown, Mgr.—equipment for manufacture of stove furnaces and general foundry work.

Que., Montreal—W. Fontaine, 94 De Rarilly St.—equipment for public garage and gasoline station, on Briand St.

Que., St. Jerome de Terrelonne — W. Filion—saw mill machinery for sash and door factory.

Opportunities for Future Business

Calif., San Francisco — Feidman Auto Metal Works 76 Eighth St. awarded contract for the construction of a 2 story, factory on 10th St. near Howard. Estimated cost $12,000.

Calif., San Francisco—White Truck Co., Van Ness Ave. and Market St., awarded contract for the construction of a factory at Mission and 11th Sts. Estimated cost $300,000.

Ill, Rockford—Rockford Show Case Co., awarded contract for the construction of a 2 story addition to factory. Estimated cost $40,000.

Ind., Columbus—Dunlap & Co.—will build a 2 story 60 x 150 ft. machine shop by day labor. Estimated cost $45,000. Private plans. Noted Dec. 18.

Md., Baltimore—Standard Gas Equipment Corp. c/o Parker Thomas & Rice, Union Trust Bldg. Archts. awarded contract for the construction of a 102 x 136 ft. factory at Hamburg & Bayard Sts. Noted Feb. 19.

Mass., Brighton (Boston P. O.) — Scott Bros., Inc., 1-3 Emery Rd., will build by day labor an addition to machine repair shop. Estimated cost $20,000. Private plans.

Mass., Cambridge—Simplex Wire & Cable Co., 210 Devonshire St., Boston, awarded contract for design and construction of a 3 story, 80 x 100 ft. factory, on Pacific St. Estimated cost $125,000. Stone & Webster, 147 Milk St., Boston, engineers and contractors.

Mass., Roxbury (Boston P. O.)—Mechanics Iron Foundry Co., 38 Kemble St., H. E. Gibby, Treas., awarded contract for the construction of a 105 x 150 ft. foundry. Estimated cost $75,000. Noted Feb. 5.

Mich., Detroit—Hudson Motor Co., 12601 East Jefferson Ave., will soon award contract for the construction of a 3 story, 80 x 639 ft. and 80 x 180 ft. assembly building for automobile plant, on Connors Ave. A. Kahn, 1000 Marquette Bldg., Archt.

Mich., Fenton—Fenton Machine Tool & Die Co., awarded contract for the construction of a 120 x 160 ft. factor addition. Estimated cost $25,000. Private plans.

Mo., Kansas City—Columbia Steel Tank Co., 1601 West 12th St., is having plans prepared for the construction of first unit of plant, 3, story, 130 x 253 ft., estiamted cost $500,000, 3 units to be built later. Total estimated cost $2,000,000. A. M. Griffin, Engr.; G. I. Sanderlin, Archt.

N. Y., Comstock—Superintendent of State Prisons, Capitol, Albany, will receive bids until March 12, for furnishing and erecting structural steel for shop building, at Great Meadows Prison, here.

O., Cleveland—Elyria Iron & Steel Co., 232 East 131 St.—H. B. Wids, Pres. is having plans prepared for a plant on East 131 St., including 3 story, 40 x 100 ft. office, 160 x 160 ft. factory addition, 70 x 100 ft. garage, 40 x 50 ft. storage building, and 40 x 46 ft. boiler house. Estimated cost $200,000. E. McGeorge, 303 Euclid Ave. Engr. and Archt.

O., Columbus — Ralston Steel Car Co., East Columbus St., has had plans prepared for the construction of a 60 x 180 ft. wheel and axle building, 50 x 70 ft. storage and 63 x 105 extension to main building. Estimated cost $65,000. Braun & Watson, 118e South High St., Engrs.

O., Youngstown — Youngstown Sheet & Tube Co.—will soon receive bids for the construction of a tube mill, including one piecing mill and two finishing mills. Estimated cost $2,000,000.